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QUARTERLY

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IN THIS ISSUE

In the article, "Fertility and Research in Fertility in Japan," Irene B. Taeuber provides an interesting account of the phenomenal decline in fertility in Japan. On the basis of her own research and the growing number of studies by Japanese students of demography and public health, she discusses the trends in abortion, sterilization, infanticide and contraception and the bearing of these trends on declining fertility. The author states that the decline in fertility in Japan since 1947 "has been so rapid and so persistent that it has forced new estimates of the probable future population and new definitions of the population problem."

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It is perhaps commonly believed that the Catholic religion constitutes one of the cultural barriers to the reduction of birth rates in Puerto Rico. A paper on this subject, "Contraception and Catholicism in Puerto Rico" was contributed by J. Mayone Stycos, Kurt Back, and Reuben Hill. The paper "attempts to show at what extent religion affects beliefs and behavior with respect to fertility and birth control in Puerto Rico." The analysis is based on three different sample surveys. "A sample of 1,000 households, representative of the total households in Puerto Rico . . . is used in dealing with questions of incidence of birth control use."

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The thirty-first of a series of reports on the Social and Psychological Factors Affecting Fertility is contributed by Erwin

S. Solomon, Jeanne E. Clare, and Charles F. Westoff. This report analyzes the significance of the fear of possible childlessness and the desire to avoid an only child as motivations affecting the conception of a second child and the desires of children for siblings as a variable influencing completed fertility. In the analysis of all three hypotheses, the sample was confined to couples who had planned the last child. The first two hypotheses were further restricted to couples (239) who had one child living at the conception of the last child. The third hypothesis relates to factors encouraging couples to have their last child and was restricted to couples (300) who had one or more children living at the conception of the last child.

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Recently several demographers have provided evidence that past declines in mortality in Western countries have contributed little or nothing to the increases in the relative number of the aged. Finding that these studies have been made "always in connection with specific numerical illustrations or with special population models," George J. Stolnitz has undertaken a more general approach in an article "Mortality Declines and Age Distribution" which is presented in this issue. The author attempts to analyze "the underlying structure of the probable relations between mortality movements and age in any population."

FERTILITY AND RESEARCH ON FERTILITY IN JAPAN

IRENE B. TAEUBER*

IF the trends in the fertility of the Japanese in the years from 1920 to 1950 are viewed in broad perspective, the downward movement is quite comprehensible to those who have studied the dynamics of fertility in Western countries.[1] In 1920 and 1925 fertility was higher in agricultural than in industrial prefectures, higher in villages than in cities, higher in the northeast than in the southwest. These relations were maintained in 1950, but levels of reproductive performance were appreciably lower in all geographic areas and all social-economic groups. Differences in age at marriage for women were similar to those in fertility. In 1950 as in 1920 the percentage of younger women who were married was highest in the agricultural areas, lowest in the great cities, but for women of all areas and in all groups age at marriage was more advanced in 1950 than it had been in 1920 or in 1930. Increasing age at marriage and declining fertility in marriage moved together; differences and trends in marital fertility were similar to those in total fertility for women in most of the age groups in the reproductive span.

This deceptively simple picture of the declining fertility of the Japanese is an artifact of the time period covered, and particularly of the specific years in which the censuses were taken. There was a period of ordered transition from 1920 to 1937; annual fertility rates deviated only slightly from a straight line

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[1] A systematic bibliography of the prewar and war publications of Japan was published in 1946: Taeuber, Irene B., and Beal, Edwin G., Jr.: Guide to the Official Demographic Statistics of Japan. Part 1. Japan Proper, 1868–1945. Supplement, *Population Index*, Vol. 12, No. 4, Oct., 1946. 36 pp. The major postwar census, that of 1950, was published by the Bureau of Statistics of the Prime Minister's Office (Sōri-fu, tōkei-kyoku) in eight numbered volumes, one including a separate volume for each of the forty-six prefectures. Detailed vital statistics for 1946 and later years were published by the Division of Health and Welfare Statistics of the Welfare Ministry (Kōsei-shō, eisei tōkei-bu).

downward trend.[2] With the mobilization of manpower and the conversion of industry for war in 1938 and 1939, there were significant declines in fertility. Economic recovery, the élan of victories, and extensive pronatalist activities brought fertility to its projected trend values in the years from 1940 to 1943. There were sharp reductions from late 1944 until early 1945 and then a major baby boom, but by 1950 fertility was close to that which would have been expected on the basis of the experience of the "normal" years from 1920 to 1937. By 1953 fertility was far below anything that could have been anticipated on the basis of prewar Japanese or Western experience. Data on births by age of mother in the years 1925, 1937, 1947, and 1953 suggest the sharpness of the transition in the postwar years as contrasted with the relatively slow transition of the prewar years.[3]

Age of Women	*Female Births per 1,000 Women*			
	1925	*1937*	*1947*	*1953*
15–49	75.7	66.7	64.9	40.6
15–19	24.0	10.8	7.2	3.6
20–24	116.8	90.6	81.6	59.3
25–29	131.2	123.9	131.0	94.0
30–34	115.5	105.2	114.2	64.5
35–39	88.8	78.4	76.6	32.0
40–44	38.4	34.1	27.9	8.9
45–49	6.5	5.1	3.4	0.6

The declines in fertility in the years from 1947 to 1950 involved the movement toward normalcy in reproductive behavior after the deep depression and sharp recovery of the late war and early postwar years. The continuation of those declines in the years from 1950 to 1954 suggests the operation of forces

[2] Time series and measures for geographic areas at given periods of time yield high correlations of crude birth rates, general fertility ratios, ratios of children to women, age-standardized rates, and gross reproduction rates.

[3] Distributions of women by age; 1925, census of that year, 1937, census of 1935 projected to 1937 on the basis of the national life table. 1947–1953, Japanese only. Nihon. Sōri-fu, tōkei-kyoku. *Zenkoku nenrei betsu jinkō no suikei*, 1951, 1952, 1953. Births by age of mother are from the annual volumes on vital statistics, Jinkō dōtai tōkei. 1925 and 1937, adjusted for under-reporting and the absence of data on the mothers of recognized legitimate births.

new at least in their intensity. The annual changes for the eight years from 1947 to 1954 indicate that the forces of decline are not yet spent. In fact, the decline has been so rapid and so persistent that it has forced new estimates of the probable future population and new definitions of the population problem.

Year	*Births per 1,000 Total Population*	*Female Births per 1,000 Women 15–49*	*Gross Reproduction Rate*
1947	34.3	64.9	2.2
1948	33.4	63.6	2.1
1949	32.8	63.3	2.1
1950	28.1	53.6	1.8
1951	25.8	48.3	1.6
1952	24.6	44.4	1.5
1953	21.4	40.6	1.3
1954	20.0	37.8	1.2

If we examine the declines in recent years by age of mother and order of birth, we see disproportionate declines in births at the beginning and end of the reproductive years and in births of higher orders. (Table 1.) Crude birth rates for prefectures classified by industrial type have maintained the traditional relationships to each other in the course of a downward movement that extended from Hokkaido and the Tohoku region of northeast Honshu to the agrarian prefectures of southwest Honshu.

Concern over the population problem of Japan became acute in the 'twenties, but studies on the extent and the formal structure of the declines in fertility that were occurring were limited, while studies of the means whereby the limitation of marital fertility was achieved were virtually non-existent. However, there were evidences of increasing interest. A special study of family and fertility was made in Tokyo in 1935.[4] Studies of the levels of fertility in the prefectures and cities were made in the late 'thirties by the Institute of Population Problems which had

[4] Tōkyō shiyakusho [Tokyo City Hall]: *Tōkyō-shi, kazoku tōkei. Shōwa ku'nen chōsa.* [Family statistics, Tokyo City. 1934 survey.] Tokyo, 1935. 370 pp.

been established on recommendation of the Commission on Food and Population.[5] Numbers of births and stillbirths had been tabulated by age of father and mother for prefectures and

Table 1. Numbers of live births per 1,000 women by age of mothers and order of birth, 1947, 1950, and 1953.

Order by Year	15–49	Quinquennial Ages						
		15–19	20–24	25–29	30–34	35–39	40–44	45–49
All Births								
1947	133.3	15.0	167.9	270.3	234.8	156.9	56.7	6.3
1950	109.8	13.3	161.4	237.6	175.5	104.8	31.6	2.3
1953	83.4	7.4	121.4	192.8	132.7	65.5	18.3	1.2
First								
1947	38.1	14.2	117.5	71.5	16.1	4.5	1.1	0.3
1950	29.9	11.7	92.8	53.1	13.0	3.6	0.7	0.0
1953	23.5	6.5	73.5	43.6	9.6	2.6	0.4	0.0
Second								
1947	27.0	0.7	40.0	92.4	31.9	7.4	1.5	0.3
1950	30.9	1.6	56.8	96.4	29.9	6.9	1.1	0.1
1953	21.3	0.8	35.7	66.4	22.4	5.1	0.8	0.1
Third								
1947	20.3	0.0	8.4	64.4	51.3	13.2	2.3	0.3
1950	18.2	0.1	10.2	57.5	42.2	10.9	1.7	0.1
1953	17.8	0.1	10.4	56.7	39.4	9.0	1.1	0.1
Fourth								
1947	15.2	0.0	1.6	28.8	54.6	21.0	3.5	0.3
1950	11.7	0.0	1.2	22.5	41.8	16.3	2.6	0.1
1953	9.8	0.0	1.6	20.6	32.6	12.1	1.7	0.1
Fifth								
1947	11.3	0.0	0.3	9.6	41.3	27.6	5.3	0.5
1950	7.5	0.0	0.2	6.2	27.1	19.3	3.7	0.2
1953	5.6	0.0	0.2	4.5	17.6	12.6	2.3	0.1
Sixth to Ninth								
1947	19.4	—	0.0	3.6	39.1	77.2	33.0	2.9
1950	10.7	—	0.0	1.8	21.3	44.9	16.5	1.1
1953	5.6	—	0.0	1.1	10.9	23.0	9.9	0.5
Tenth and Higher								
1947	2.0	—	—	0.0	0.5	6.0	10.1	1.7
1950	1.0	—	—	0.0	0.2	2.9	5.3	0.6
1953	0.4	—	—	0.0	0.1	1.1	2.1	0.3

Sources of Data: Births: Nihon. Kōsei-shō, eisei tōkei-bu. Jinkō dōtai tōkei. 1947–1953. Population estimates: 1948–1950: *Ibid.* Vital and Health Statistics of Japan. Part II, Table I-I. 1951–1953; Nihon: Sori-fu, tōkei-kyoku. Zenkoku nenrei betsu jinkō no suikei. 1951, 1952, and 1953.

[5] Tachi, Minoru, and Ueda, Masao: Taishō ku'nen, Taishō jūyo'nen, Shōwa go'nen, Shōwa jū'nen. Dō fu ken betsu, shi gun betsu hyōjunka shussei ritsu, shibō ritsu oyobi shizen zōka ritsu. [Standardized Birth Rates, Death Rates, and Rates of Natural Increase by Prefectures, for 1920, 1925, 1930, and 1935.] *Jinkō mondai kenkyū* April, 1940, 1, No. 1, pp. 21–28. Also: *Idem.* Shōwa jū'nen naichi

(Continued on page 133)

large cities in 1925 and 1930;[6] in 1937 and later years national vital statistics included tabulations by age of mother and occasionally of father.[7]

In 1938 and 1939 birth rates dropped sharply and the problem of fertility became defined as one of inadequacy rather than of super-abundance. In 1940 a major field study was conducted in an attempt to secure the reproductive histories of women of completed fertility and to relate the levels of the completed fertility to the social and economic characteristics of the women and their husbands.[8] Some 137 thousand schedules were

127 shi hyōjunka shussei ritsu, shibō ritsu, oyobi shizen zōka ritsu. [Standardized Birth Rates, Death Rates, and Rates of Natural Increase for the 127 Cities in Japan in 1935.] *Jinkō mondai kenkyū* August, 1940, 1, No. 5, pp. 20–27. Summaries of these studies were issued by the Institute in English in 1948.. There was a major development in formal demographic research in the Biometrics Institute of what was then the Imperial University of Keijo in Korea under the direction of Professor Haruo Mizushima. Intrinsic birth rates and gross and net reproduction rates were computed for the prefectures of Japan and for selected cities. *See especially:* Koyama, Yūkichi: Fu ken betsu shin no jinkō shizen zōka ritsu. [The True Rates of Natural Increase of Population for Each Prefecture in Japan, 1930.] *Chōsen igakkai zasshi* [Journal of the Korean Medical Association] 1941, 31, No. 2, pp. 1–15. Fu ken betsu shin no jinkō shizen zōka ritsu dai-2-kai, Shōwa 6–10 nen. [The Second True Rates of Natural Increase of Population for Each Prefecture in Japan, 1931–1935.] *Idem,* 1942, 32, No. 7, pp. 11–19.

[6] Nihon. Naikaku tōkei-kyoku: Fubo no nenrei to shussei to no kankei. [Births in Relation to Age of Parents.] Chōsa shiryō [Research Materials], No. 1. Tokyo, 1927. 55 pp. *Idem.* Fubo no nenrei betsu shussei tōkei, Taishō 14-nen. [Statistics on Fertility by Age of Parents. 1925.] Tokyo, 1927. 99 pp. *Idem.* Fubo no nenrei betsu shussei oyobi shisan tōkei, Showa go'nen. [Statistics of Live Births and Stillbirths by Age of Parents in 1930.] Tokyo, 1935.

[7] Nihon. Naikaku tōkei-kyoku. Jinkō dōtai tōkei. [Vital Statistics.] 1937–1942; 1943 unpublished. In 1937 and 1938 tabulations of births by legitimacy status by age of mother were published for the total country and for cities of 100 thousand and over as a group. In 1939 the tabulations for cities of 100 thousand and over were omitted, but a tabulation of births to Japanese women living outside Japan was added. There were also distributions of births by age of mother for Karafuto.

[8] Okazaki, Ayanori: Shussanryoku chōsa kekka no gaisetsu. [Outline on Fertility Investigation Results.] *Jinkō mondai kenkyū* October, 1940, 1, No. 7, pp. 1–95. Birth-Intervals according to Birth-Orders. A Research from the Result of Investigation on Fertility Surveyed in 1940. Jinkō mondai kenkyūjo. Demographic Researches, A-11. Tokyo, 1948. Fūfu kankei jizoku kikan to shussanryoku. [Duration of Married Life and Fertility.] *Jinkō mondai kenkyū* February, 1946, 5, No. 2, pp. 1–14. Investigation on the Differential Fertility by Marriage Ages, Duration of Married Life, Level of Education, Occupations, and Economic Ranks of Husband and Wife. Surveyed in 1940. Jinkō mondai kenkyūjo, Social-Economic Researches, B-2. Tokyo, 1948. Nōgyōsha no shussanryoku ni kansura tōkeiteki kansatsu. [Statistical Observations on the Fertility of Farmers.] *Jinkō mondai kenkyū* September, 1951, 7, No. 2, pp. 1–18. Also: Fertility of the Farming Population in Japan. Tokyo, 1951. 17 pp. And: Toshi ni okeru kyūryō seikatsusha no shussanryoku. [Fertility of Salaried Men in an Urban Area.] *Jinkō mondai kenkyū* October, 1952, 8, No. 2, pp. 1–9. (With Sato, Y.)

distributed by government officials, organizations, and business firms in areas and groups purposively selected; 81 thousand were returned, and 11 per cent of these were eliminated as incomplete or erroneous. In general, demographic patterns and the economic and educational variations were similar to those of Western countries in their periods of still high but declining fertility. Two other large studies of fertility were made in the war years, but here also contemporary analysis was limited and no postwar analysis is known.[9] There were many less ambitious studies during this period as professional and educational resources were mobilized in the interests of a great pro-natalist policy.[10]

Interest in and legal attention to abortion and infanticide suggest that these means of limitation had survived even in the period of the late prewar and war years. Legal prohibitions of the sale of contraceptives and enforcement regulations concerning abortions may be assumed to have been related to the practices considered in the legislation. Field studies indicated the survival of practices of *mabiki*,[11] and major research attention

[9] Koyama, Eizō: Investigation on the Fertility of Koreans in Japan. Surveyed in 1940 about 48,000 Couples. Nihon. Kōsei-shō, jinkō mondai kenkyūjo, Social Economical Researches, B-5. Tokyo, 1948. 24 pp. And: Shimamura, T.: Research on Difference in Fertility as Occupations of Wives Vary. Surveyed 1943. Nihon. Kōsei-shō, jinkō mondai kenkyūjo, Social-Economical Researches, B-3. Tokyo, 1948. (An analysis of 40 thousand cases from 60 *machi* and *mura* in 10 prefectures.)

[10] The diversity and the magnitude of this literature is apparent in the publications of a series of national conferences on population held by the Institute for Population Research, Jinkō mondai kenkyū-kai, a semi-official institution, in the years from 1938 to 1942. *See especially*: Dai-ikkai jinkō mondai zenkoku kyōgi-kai hōkokusho. [First National Conference on Population Problems.] Tokyo, 1938. 828 pp. Dai-nikai jinkō mondai zenkoku kyōgi-kai hōkokusho. [Second Conference on Population Problems.] 1939. 1104 pp. Dai-sankai jinkō mondia zenkoku kyōgi-kai hōkokusho. [Third National Conference on Population Problems.] 1941. 956 pp. Dai-yonkai jinkō mondai zenkoku kyōgi-kai kaihō. [Summary report. Fourth National Conference on Population Problems.] 1941. 142 pp. Dai-gokai jinkō mondai zenkoku kyōgi-kai kaihō. [Summary report. Fifth National Conference on Population Problems.] 1942. 124 pp.

[11] Saitō, Kiyoshi, and Homma, H.: Nyūyōji shibō o shiheisura inshi ni kansura kenkyū. Ibaraki-kenka nōson ni okeru chōsa kenkyū, Dai-ippo, jumbi chōsa to sono seiseki no kenkyu. [Causal Factors in Mortality of Infants and Pre-School Children. An Analysis of a Village in Ibaraki-ken. Report 1. Results of Preliminary Survey and Its Statistical Analysis.] *Kōshū eisei* [Journal of Public Health] January, 1943, 4, No. 1, pp. 76–88. *Idem*. Dai-nihō, nyūyōji shibō gen'in no shinso. [Report No. 2 Causes of Death of Infants and Pre-School Children.] *Ibid*. September, 1947, 6, Nos. 1–2, pp. 6–10.

was given to the levels of fertility and the infanticide practices of the late Tokugawa and early Meiji eras.[12]

In postwar Japan the population problem was acute and the realization of it widespread. The consequence was a notable extension of the scope of census and vital statistics data on fertility, an increase in the collection and analysis of data by government agencies and research institutes at all administrative levels, public attention to and some study of fertility by newspapers and public opinion institutes, and research by people in universities. Each move toward policy was accompanied by a survey of the situation if not by new research. The Economics Council Board, the Ministry of Labor, the Ministry of Agriculture, and the Repatriate Relief Board were among the many government agencies that found population an element in their assessments of the present and their projections of the future.

In 1947 and later years there were more numerous tabulations on fertility, but data for demographic analysis as contrasted with public health evaluations remained limited.[13] Births have been tabulated by legitimacy status and age of mother, and by age of mother and birth order but not by legitimacy status. In 1951 and 1952 live births were given by total birth order for the individual prefectures; in 1952 there were prefectural data on legitimate births by duration of marriage. And, also in 1952, numbers of legitimate births were related to the ages of fathers and of mothers. Presumably detailed data on births by age of mothers and of fathers and by parity will be published for the prefectures as of the census years 1950 and 1955. It is to be hoped that the more detailed data in the volumes for recent years 1951 and 1952 presage more adequate data for the years

[12] The term *mabiki*, literally thinning, was used for infanticide. *See especially*: Honjō, Eijirō: Nihon Jinkō Shi. [History of Japanese Population.] Tokyo, Nihon hyōron-sha, 1941. 429 pp. Sekiyama, Naotarō: Nihon Jinkō Shi. [History of Japanese Population.] Tokyo, 1942. 261 pp., 3 tables. Takahashi, Bonsen: Nihon Jinkō Shi no Kenkyū. [Studies in Japanese Demographic History.] Tokyo, Sanyū-sha, 1941. 853 pp.

[13] Nihon. Kōsei-shō, eisei tōkei-bu. Welfare Ministry. Division of Health and Welfare Statistics: Jinkō dōtai tōkei, 1947–.

from 1954 to 1956, when the data on age and marital status as of 1955 will be available for prefectures, cities, and minor civil divisions.

The census of 1950 included a question on number of children ever born; the results of the initial analysis were included in the publications of the results of a 10 per cent sample tabulation.[14] A more detailed analysis now in process will relate the reproductive histories to the social and economic characteristics of the women and their husbands for the major urban-rural groups and the broad sub-cultural regions of the country. These data on the fertility of women in 1950 portray the net levels of reproduction at specified ages as influenced by the secular trends in national fertility, the dislocations and losses of the years of war, and the compensatory movements in the postwar years.

Table 2. Number of children ever born per 1,000 total women, by age, prefectures by industrial type, 1950.

Age of Women	All Japan	Prefectures by Industrial Type[a]				Hokkaido
		Metropolitan	Other Industrial	Transitional	Agricultural	
15-49[b]	2,634	2,085	2,455	2,689	2,825	2,991
15–19	17	14	15	20	17	18
20–24	416	296	389	452	443	458
25–29	1,423	1,170	1,329	1,466	1,490	1,754
30–34	2,588	2,134	2,468	2,589	2,746	3,176
35–39	3,641	2,960	3,374	3,630	3,949	4,434
40–44	4,388	3,411	4,044	4,336	4,857	5,396
45 and Over	4,632	3,864	4,355	4,563	4,928	5,774

Sources of Data: Nihon. Sōri-fu, tōkei-kyoku: Shōwa 25-nen Kokusei Chōsa Hōkoku. Population Census of 1950. Vol. III. 1. Table 28.

[a] Prefectures were classified according to the proportion of the gainfully occupied in agriculture in 1930; comparable classifications for other years would have differed only slightly from the classification on the basis of the situation in 1930. Metropolitan prefectures are those with less than 20 per cent of the gainfully occupied in agriculture, other industrial prefectures those with 20 to 39 per cent gainfully occupied in agriculture. In the transitional prefectures 40 to 59 per cent were gainfully occupied in agriculture; the comparable percentage in the agricultural prefectures was 60 or more. Because of its economic, demographic, and cultural differences, Hokkaido is presented as a distinct region.

[b] Under 15 are classified with 15 to 19, 50 and over with 45 to 49.

[14] Nihon. Sōri-fu, tōkei-kyoku: Shōwa 25-nen kokusei chōsa hōkoku. Population census of 1950. III. 1. 10% Chushutsu Shūkei Kekka, Sono Ichi. Danjo Betsu, Nenrei, Haigū Kankei, Kokuseki Mata Wa Shusshin-Chi, Kyōiku, Shotai, Jūtaku, Shussanryoku. Results of Ten Per Cent Sample Tabulation. Part 1. Sex, Age, Marital Status, Citizenship, Education, Household, Housing, Fertility. Tokyo, 1952. 206 pp.

The completed fertility of women aged 45 to 49 and above reflects the levels and differentials of fertility in the historic "normal" Japan of the period prior to the Manchurian venture and the continental involvement. For all age groups of women and for all marital status categories and durations of marriage there was a direct association between agricultural life and high fertility, between industrial activities in the monetary economy and reduced fertility. The data on numbers of children ever born per 1,000 total women by age in prefectures classified by industrial type are given in Table 2. They are illustrative of the signal contribution to demographic knowledge made by the inclusion of a question on fertility in the schedule of the census of 1950.

Soon after the end of the war the Institute of Population Problems of the Welfare Ministry made the first of a long series of studies of contraceptive practice.[15] These studies indicated the number of women who reported that they were then practicing or had once practiced contraception; they revealed an urban-rural and a professional-agricultural continuum in admitted practice rather similar to that in Western cultures. Their results were quite consistent with the observed trends in numbers of live births by age, birth order, and urban-rural or rural-agricultural character of the area of residence of the women. In only a few cases, however, were there attempts to secure detailed case histories that would permit measures of the effectiveness of contraceptive practice.[16] The deficiency was almost

[15] Nihon. Kōsei-shō, jinkō mondai kenkyūjo: Tōkyō-to chūshin to suru sanji seigen no jittai ni kansuru shiryō. [Materials on the Actual Situation of Birth Control Centering on Tokyo Metropolitan Area.] Tokyo, 1949. 34 pp. Revised, 1949. 24 pp. Also: Shinozaki, Nobuo: The Investigation on the Actual State of the Practice of Contraception in Japan. Surveyed in 1947. Social-Economical Researches, No. 11. Tokyo, 1948. Also: Nihon. Kōsei-shō, jinkō mondai kenkyūjo: Ken betsu oyobi toshi, chō, son betsu sanji chōsetsu jittai chōsa shukei kekka hyō. [Tables on Results of Survey on Birth Control by Prefecture and by *toshi, chō* and *son.*] Report No. 76. Tokyo, 1952. 30 pp. (Report on a Survey in 17 Prefectures in 1949 and 1950.) And: Shinozaki, Nobuo: Nihon ni okeru sanji chōsetsu fukyū no genjō. Pp. 50–57. Present Condition of Spread of Birth Control in Japan. Pp. 65–75. In: Nihon jinkō gakkai. The Population Association of Japan. *Nihon jinkō gakkai kiyō. Archives of the Population Association of Japan.* No. 1. Tokyo, 1952.

[16] Aoki, Hisao. Waga kuni ni okeru sanji seigen jikkō kōka no sokutei—pāru no

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inherent in the research situation in Japan. Contraception was not diffusing through organized clinics whose records could be used for analytical purposes. Studies in the general population would have required funds and research facilities of an order of magnitude not possessed by the Institute of Population Problems.

Polls and surveys of expressed attitudes toward contraception and contraceptive practice were numerous. One, that of the National Public Opinion Institute, was based on a national sample and presented with its results carefully analyzed and evaluated.[17] It is this survey, however, that casts major doubt on the results of the many cursory surveys presumed to measure attitudes toward and practice of contraception. Here all but five per cent of the people who answered the questions were confused as to the distinction between birth limitation as a generic term and contraception.

The Mainichi Newspaper Company through its Population Problems Council not only kept the question of fertility before a substantial segment of the Japanese people but conducted field surveys that bore directly or indirectly on the levels and correlates of fertility. The first of a series of studies on fertility control was made in 1950.[18] Like the later studies, it was based on a sample of the national population, and it secured data on the social and economic as well as the demographic characteristics of the women and their husbands. There were detailed questions on opinions as to the social acceptability and the morality of limitation, the sources of information as to techniques, and the specific means utilized. This first study was

sokutei-hō ni yoru Tōkyō-to ka kiō chōsa kekka no sai-shūkei. [The Effectiveness of Contraceptive Practice in Japan . . .] *Jinkō mondai kenkyū* June, 1950, 6, No. 2, pp. 67–73. *Ibid.* Chihō ni okeru jutai chōsetsu no jikkō kōka ni tsuite-Yamakata-ken jūgo shi, chō, son no moderu chōsa. [The Effectiveness of Contraceptive Practice in Local Districts. Model Survey in 15 Cities, Towns, and Villages in Yamagata Prefecture.] *Jinkō mondai kenkyū*, September, 1951, 7, No. 2, pp. 19–28.

[17] Nihon. Kokuritsu yoron chōsa kenkyūjo. National Public Opinion Research Institute: Public Opinion Research on Population. Research No. A-10. Tokyo, 1950. 2, 47 pp.

[18] Mainichi shimbun-sha. Jinkō mondai chōsa-kai. Mainichi Press. Population Problem Research Council: A Survey of Public Opinion in Japan on the Readjustment of Over-Population. Population Problems Series No. 3. Tokyo, 1951. 31 pp.

limited to contraception; the second and third studies included some materials with reference to abortions.[19]

While contraception was becoming increasingly significant as a subject of controversy and field for research, the legal basis for the diffusion of a more comprehensive fertility limitation was being prepared. Revisions of the Pharmaceutical Control Law permitted the production and sale of contraceptives. The Eugenics Protection Law as passed in 1948 and amended in the succeeding years was designed to prevent the increase of inferior descendants and to protect women for whom pregnancy would involve health hazards.[20] The bases for passage were overtly eugenic and medical, not demographic, but the three provisions of the law relative to fertility established what amounted to government sponsorship of the extension of contraceptive facilities, legalized abortions by private physicians, and sanctioned voluntary sterilization. As government controls were relaxed and the non-medical reasons for birth limitation were interpreted more liberally, the numbers of reported abortions increased sharply—from 246 thousand in 1949 to 748 thousand in 1952 and 1,143 thousand in 1954.[21] Numbers of reported induced abortions per 1,000 women aged 15 to 49 increased from 23.1 in 1950 to 47.7 in 1953 and 50.2 in 1954; the number of induced abortions per 1,000 live births increased from 209 in 1950 to 572 in 1953. The incidence of abortions in

[19] Mainichi shimbun-sha. Jinkō mondai chōsa-kei. Mainichi Press. Population Problem Research Council: Public Opinion Survey on Birth Control in Japan. By Tatsuo Honda. Population Problems Series No. 7. Tokyo, 1952. 55 pp. Third Public Opinion Survey on Birth Control in Japan. By Tatsuo Honda. Population Problems Series No. 13. Tokyo, 1955. 38 pp.

[20] Nihon. [Japan.] [Eugenics Protection Law, Law No. 156 of 1948.] Tokyo, 1948—[Amended as of April, 1952.] 1952. [Status as of August, 1954.] 1954. *See particularly:* The Eugenic Protection Law, pp. 8–19 in: Mainichi shimbun-sha, jinkō mondai chōsa-kai. Some Facts about Family Planning in Japan. By Minoru Muramatsu. Tokyo, 1955. 120 pp.

[21] Nihon. Kōsei-shō, kōshū hoken-kyoku. Welfare Ministry. Public Health Bureau. General Affairs Section: Activities under the Eugenic Protection Law for the Year of 1949–. Tokyo, 1950–. (The last report used was that for 1953, issued in 1954.) *See also:* Nihon. Kōsei-shō. Ministry of Health and Welfare: Summary of the Program to Promote Conception Control. Bureau of Public Sanitation. Western Pacific Regional Seminar in Vital Statistics /VS/13. Tokyo, 1952. 17 pp. (Statement prepared by Y. Koya, Institute of Public Health.) *Also:* Mainichi Shimbun-sha, jinkō mondai chōsa-kai: *op. cit.*, pp. 20–32 and 69–71.

relation to numbers of women and the frequency of childbearing at the various ages reveal abortions not as aberrant phenomena but as modal means of fertility control in the society. (Table 3.) Proportionate reduction in fertility through abortion was greatest at the young ages where few women were married and at the older ages where childbearing was not appropriate to the role of the wife. In absolute terms, however, abortions were most frequent at the ages of maximum childbearing. In all years for which data are available, more than 85 per cent of all women having induced abortions reported as such were in their twenties and thirties. More than forty per cent of all reported abortions were secured by women in their twenties, the age at which in theory they should have been fulfilling their

Table 3. The incidence of induced abortions by age, 1950–1954.

Age of Woman	1950	1951	1952[a]	1953	1954[b]
	Abortions per 1,000 women				
All Women	23.1	29.6	36.3	47.7	50.2
15–19	4.0	4.7	3.8	3.9	3.7
20–24	28.3	37.5	33.3	42.6	43.6
25–29			57.2	76.9	81.2
30–34	39.4	49.7	65.9	88.0	92.7
35–39			59.2	76.7	81.8
40–44	20.3	14.5	32.5	41.4	42.4
45–49			4.2	5.7	5.6
	Abortions per 1,000 live births				
All Women	209	299	398	572	—
15–19	302	441	432	525	—
20–24	144	212	254	351	—
25–29			278	399	—
30–34	279	391	443	663	—
35–39			765	1,172	—
40–44	592	879	1,411	2,259	—
45–49			3,149	4,877	—

Sources of Data: Populations, Estimates of the Bureau of Statistics; Live Births, Reports of the Division of Health and Welfare Statistics, Ministry of Welfare; Abortions by Age of Woman, Mainichi shimbun-sha, jinkō mondai chōsa-kui, Some Facts about Family Planning in Japan. Pp. 24–25.

[a] Age of women having abortions in the year assumed to be the same as the reported numbers in the last half of the year.

[b] Live births by age of mother not available.

familial responsibilities for the succession of the generations. The proportion of all abortions secured by women aged 25 to 29 was 25.6 in 1952, 26.3 in 1953, and 26.7 in 1954. Numbers of abortions per 1,000 women or per 1,000 live births to women in this age group were moving very sharply upward.

The trends in fertility and in research on fertility in Japan in the last six or seven years have been so complex as to defy easy summary. The most spectacular development was the rapidity and extent of the resort to abortions to terminate unwanted pregnancies, but abortions are not amenable to simple reporting systems or research designs. Substantial proportions of reports are erroneous as to names or addresses, and substantial proportions of the occurrences are not reported. Reticence if not shame seems to surround the resort to induced abortion. Moreover, abortions performed prior to the fourth month of the pregnancy—and a major proportion of them are—escape reporting through the stillbirth reporting systems. There are some indications that rather complex tabulations with cross-classifications by age of mother and order of pregnancy are now being made, but they do not seem to be included in the regular statistical publications of the Division of Health and Welfare Statistics of the Ministry of Welfare.

The major puzzle presented for demographic research involves the relations between the declines in fertility, the increasing numbers of reported abortions, and the increasing frequency of contraceptive practice. Perhaps the most critical of the theoretical questions are those concerning the interrelations of contraception, abortion, and sterilization and the relevance of these to the frequency of marriages, the characteristics of the married, the spacing of births, the size of completed families, and the prospects for the population of the future. There have been some attempts to measure the influence of reported or hypothetical numbers of abortions on numbers of births;[22] there

[22] Terao, Takuma, and Ozaki, Iwao. Bankon to hinin no jinkō seigenteki kōka to sono sokutei. Pp. 58–65. Restrictive Effects of Late Marriage and Contraception upon Increase of Population and Measurement Thereof. Pp. 76–85. In: Nihon jinkō gakkai. The Population Association of Japan. *Nihon jinkō gakkai kiyō. Archives of the Population Association of Japan.* Tokyo, 1952.

have been attempts to segregate the influence of various factors in the declines in fertility between 1925 or 1930 and the time of study.[23] The most fruitful approach, though, lay in the direct analysis of limitation practices. Major studies were made by the Institute of Population Problems of the Welfare Ministry, the Population Problems Council of the Mainichi Newspapers, and the Institute of Public Health of the Welfare Ministry. They will be noted in this order.

The Institute of Population Problems has continued its studies of contraceptive practice, although they have not been given major emphasis in its research program. A national sample survey of fertility was made in 1952, the enumeration being conducted by the Bureau of Statistics and utilizing the sample designed for the Monthly Report on the Labor Force.[24] Information on contraception and abortion was secured through leaving a questionnaire with women who were in the disappearing third of the Labor Force sample and asking them to mail it in. The analysis of the data thus secured was devoted primarily to levels of reproductive performance in relation to demographic, economic, and social characteristics. Neither the design of the study nor the analysis was oriented toward the study of the incidence, the demographic aspects, or the economic, urban-rural, and social correlates of the declines in current fertility. The returns in the mailed schedules on limitation were deficient, but they indicated that abortions were resorted to in a major portion of the cases where pregnancy had resulted from contraceptive failures.[25]

[23] Kubo, Hideshi. Saikin no shussan chōsetsu no shussei ritsu ni taisuru eikyō. Pp. 12–16. The Influence of Birth Control against Birth Rate in Japan. Pp. 16-21. In: Nihon jinkō gakkai. The Population Association of Japan. *Nihon jinkō gakkai kiyō. Archives of the Population Association of Japan,* No. 1. Tokyo, 1952. 102, 130 pp.

[24] Okazaki, Ayanori: A Fertility Survey in Japan of 1952. Tokyo, Ministry of Welfare, Institute of Population Problems, 1953. 87 pp. Nihon. Kōsei-shō jinkō mondai kenkyūjo. Sanji chōsetsu no fukyū jōkyō ni kansuru chōsa. [A Survey of the Extent of Contraceptive Practice.] Report No. 85, 1952. Tokyo, 1953. 33 pp. Also: Dai-niji, Shōwa 27-nen, shussanryoku chōsa no sokuhō. Report No. 87, 1952. Tokyo, 1953. 53 pp.

[25] Honda, Tatsuo: A Survey of Spread of Birth Control. Tokyo, Welfare Ministry, Institute of Population Problems, 1953. 37 p.

The early Mainichi study of fertility control has been noted previously. The second survey, taken in 1952, and the third, taken in 1955, included questions as to abortions.[26] These surveys indicated a definite relationship between the practice of contraception and the resort to induced abortion. Women admitting abortions reported previous contraceptive practice; few women not admitting contraceptive practice admitted abortions. The demographic, economic, and urban-rural incidence of abortions and contraceptive practice were quite similar. The increases in reported contraceptive practice were extraordinary. They characterized all age classes and all social and economic groups in cities and in rural areas. Between 1950 and 1952 the relative increases in the percentages practicing were greatest in the six great cities, intermediate in the other *shi* (cities), and least in the *gun* (areas outside the *shi*). (Table 4.) Between

Table 4. The practice of contraception, 1950, 1952, and 1955 (per cent of couples admitting practice.)

Area	Per Cent of Couples			Increase in Practice			
				Amount		Per Cent	
	1950	1952	1955	1950–1952	1952–1955	1950–1952	1952–1955
	PRESENT PRACTICE						
All Japan	19.5	26.3	33.6	6.8	7.3	34.9	27.8
Six Cities	23.7	34.8	37.7	11.1	2.9	46.8	8.3
Other Shi	23.6	31.1	34.0	7.5	2.9	31.8	9.3
Gun	17.4	22.1	31.9	4.6	9.8	38.5	44.3
	EVER PRACTICED						
All Japan	29.1	40.2	52.5	11.1	12.3	38.1	30.6
Six Cities	35.7	52.0	56.6	16.3	4.6	45.7	8.8
Other Shi	32.9	46.0	52.9	13.1	6.9	39.8	15.0
Gun	26.6	34.6	50.8	8.0	16.2	30.1	46.8

Sources of Data: Mainichi shimbun-sha, jinkō mondai chōsa-kai. Public Opinion Survey on Birth Control in Japan. Pp. 30–31. Third Public Opinion Survey on Birth Control in Japan. Pp. 23–24.

[26] References, footnote 19.

1952 and 1955, on the other hand, increase was relatively slight in the six great cities and the other *shi*, but it was rapid in the *gun*.

In the spring of 1954 the Welfare Ministry used an attached questionnaire on contraceptive practice with its annual survey of a one per cent sample of households. Preliminary results indicate a sharp increase in the extent of contraceptive practice, an increase that was especially great in the *gun* in general and in the originally high fertility prefectures of the Tohoku region in particular.[27] This study, taken in conjunction with the earlier studies of the Institute of Population Problems and the Mainichi Population Problems Council, indicates that increas-

Table 5. Crude birth rates in selected prefectures, 1920–1925 to 1953.

Prefectures	Years				
	1920–1925	1930–1935	1947	1950	1953
Northeastern Japan					
Aomori	44.8	40.9	41.5	36.0	28.8
Iwate	42.1	38.2	36.5	33.9	27.2
Miyagi	41.6	36.9	35.4	32.0	25.1
Akita	43.4	39.3	38.0	32.6	25.7
Yamagata	40.5	35.8	32.8	30.0	22.8
Fukushima	40.3	35.7	35.7	32.8	25.9
Southwestern Japan					
Kumamoto	34.8	32.3	34.6	30.3	24.5
Oita	35.3	32.0	34.3	29.3	23.0
Miyazaki	36.6	35.6	37.6	32.4	25.4
Kagoshima	37.2	35.0	33.6	30.5	26.0

Sources: The rates for the intercensal periods prior to the war are based on births adjusted for mal-registration and under-reporting and related to the total population; they concern the prewar area of the country. The rates for 1947 and 1950 are the official rates of the Division of Health and Welfare Statistics of the Ministry of Welfare; births of Japanese allocated to place of residence are related to total populations. The births for 1953 are the preliminary figures from the summations of the monthly reports; they pertain to Japanese only. The populations are the estimates of Japanese populations made by the Bureau of Statistics of the Prime Minister's Office. The discrepancies are not sufficient to bar comparisons in agricultural prefectures such as the ones considered here. Declines are slightly less rapid if comparisons are made using preliminary reports on numbers of births for 1947, 1950, and 1953. It should be noted that fertility has declined substantially since 1953. It should also be noted that age structures are becoming progressively more favorable for reproduction so that crude rates under-estimate the magnitude of the declines in fertility that are occurring.

[27] Nihon. Kōsei-shō: [Survey of Prevalence of Contraceptive Practice in Japan . . . April 1, 1954.] Kōsei no shihyō [Welfare Index], October, 1954. Translated by M. Muramatsu. *See also:* Mainichi shimbun-sha, jinkō mondai chōsa-kai. Some Facts About Family Planning in Japan. Pp. 87–93.

ing proportions of the women in the agricultural villages have adopted precautionary as well as *ex post facto* means of planning family size. The relations between the diffusion of abortion and contraception in the remote agricultural areas are not yet portrayed clearly.[28] Whatever the nexus of forces and whatever the means, however, declines in fertility are coming rapidly. The data on crude birth rates given in Table 5 suggest the magnitude of the declines in the agricultural prefectures of the Tohoku region of northeastern Japan and in the agricultural prefectures in Kyushu in southwestern Japan.

The most distinctive of the studies undertaken in Japan in recent years are those of the Department of Public Health Demography of the Institute of Public Health. Since the legal basis for the extension of contraceptive services in Health Centers and the performance of abortions and sterilizations by physicians was predicated largely on the protection of the health of mothers and children, there was a broad range of problems that lay specifically within the domain of the national health services. Moreover, the wide prevalence of abortions, and particularly the known existence of multiple abortions to individual women, was believed to constitute a health hazard of major proportions. Experimental studies were designed and implemented, first in three agricultural villages and later among the employees of a coal mining company, to determine the feasibility of, and the requirements for, the substitution of contraception for abortion.[29] Field studies were also undertaken. The first, time-limited in its relevance, was a detailed study of the demographic characteristics, the economic background, the attitudes, and the reproductive histories of women

[28] For summary and analysis of data available to 1950, see: Shinozaki, Nobuo: NIHONJIN NO SEI SEIKATSU. [SEXUAL LIFE OF THE JAPANESE.] Tokyo Bungei shuppan-sha, 1953. 276 pp. English summary: Report of Sexual Life of Japanese. Jinkō mondai kenkyūjo, Research-data C., No. 11. Tokyo, 1951. 38 pp.

[29] Koya, Yoshio, et al.: Research on Population Health, Especially Test Studies in Three Rural Villages. Published on behalf of The Japan Association of Public Health. Tokyo, 1952. 27, 28 pp. Bilingual, Japanese and English. *Idem.* [A Study of Family Planning of Coal Miners.] Nihon iji shimpō, No. 1573. June 19, 1954. *Idem.* Present Situation of Family Planning among Farmers and Coal Mine Workers in Japan. United Nations World Population Conference, E/CONF. 13/50. Rome, 1954. 7 pp.

having induced abortions with the approval of a Eugenics Protection Committee, together with an analysis of the physical and psychological consequences of the abortions.[30] There was also an intensive field study of the background, status, and adjustments of women who had been sterilized.[31] The methodological significance of these studies lies in the fact that they are public health demography in plan, field work, and analysis. Work was done within and under the auspices of the Institute of Public Health. All interviews were conducted by doctors; publication was by doctors in medical or health journals. The research was accepted as an appropriate aspect of health service. The substantative results have demographic significance, also, for in the reproductive histories of the individual women there are sequential relations between contraception and abortion. Sterilization emerges as a permanent solution to problems of unacceptable means.

The unanswered questions as to fertility in Japan are numerous. Data remain inadequate for the analysis of the structure and the social-economic correlates of fertility at its existing levels and in its downward movements. Census and vital statistics data are not coordinated, and neither emphasizes fertility. However, activities contemplated or under consideration may antiquate these statements with their implied criticisms. Special analyses of 1950 data on children ever born and the 1955 data

[30] Koya, Yoshio; Muramatsu, Minoru; Agata, Sakito; and Koya, Tomohiko: Waga kuni ni okeru jinkō ninshin chūzetsu no kōshū eisei narabini jinkōgakuteki kenkyū. Pp. 1–19. (Preliminary Report on a Survey of Health and Demographic Aspects of Induced Abortion in Japan.) Pp. 1–9. In: Nihon jinkō gakkai. The Population Association of Japan. *Nihon jinkō gakkai kiyō. Archives of the Population Association of Japan,* Tokyo, 1953, No. 2. 92, 102 pp. Also, in Japanese: *Nihon iji shimpō,* Oct. 24, 1953, No. 1539. In English: Milbank Memorial Fund *Quarterly* July, 1954, 32, No. 3, pp. 282–293. Also: Koya, Yoshio, and Muramatsu, Minoru: Waga kuni ni okeru jinkō ninshin chūzetsu no kōshū eisei narabini jinkōgakuteki kenykū shōhō. Sono ichi. A Survey of Health and Demographic Aspects of Induced Abortion in Japan. Special Report No. 1. *Kōshū eisei-in kenkyū hōkoku* June, 1953, 3, No. 1, pp. 10–13. Special Report No. 2. *Ibid.* December, 1953, 3, Nos. 2–3, pp. 18–24. Special Report No. 3. *Ibid.* September, 1954, 4, Nos. 1–2, pp. 1–9. Special Report No. 4. *Ibid.* June, 1955, 4, No. 3.

[31] Koya, Yoshio: Muramatsu, Minoru; Agata, Sakito; and Suzuki, Naruo: A Survey of Health and Demographic Aspects of Reported Female Sterilizations in Four Health Centers of Shizuoka Prefecture, Japan. Milbank Memorial Fund *Quarterly,* October, 1955, 33, No. 4, pp. 368–392. In Japanese: *Nihon kōshū eisei* December, 1954, 1, No. 10, pp. 11–20.

on children enumerated in the various areas and social-economic groups will be substantial contributions. If the monographic materials on vital statistics for 1950 are published and extended data on parity and marital durations are continued for the years from 1954 through 1956 for prefectures, knowledge can begin to substitute for deduction and speculation in many fields.

It would be difficult to over-emphasize the importance of data and analysis on fertility in Japan. To the broad problem of the relations between economic modernization of an industrial type and fertility has been added the array of problems associated with a sharp drop in fertility. Japan's experience may be thrust aside as relevant only to Japan on a variety of grounds: The precipitant declines of recent years occurred in a country that had had a century of economic modernization, three-quarters of a century of compulsory education, and perhaps sixty years of slowly declining fertility; the resort to abortion occurred in a culture with a tradition of rational control that was within the memory of the grandparents of today's youth; Japanese culture is unified and its people disciplined. These are easy arguments. It is possible, however, that there are elements of commonality as well as uniqueness in the demographic history of Japan in contrast with her neighbors. The external analyst is disturbed by questions as to the relative roles of traditions, of government policy or implicit government approval, of massive public debate, of a deep economic and spiritual crisis, and of aspirations for which fulfillment is not anticipated. These questions, it is submitted, are as significant for research as those involving the means whereby motivations to limit reproduction become manifest in reduced fertility.

The real unknown in Japan is the cultural and psychological process whereby a generalized wish to regulate reproduction became the basis for incisively implemented practice. There is the further significant question of the social, psychological, and political consequences of a reduction in fertility such as that occurring in Japan. The experience of the countries of the West

indicates slight likelihood of a cessation or reversal of decline until fertility has gone appreciably below the levels necessary for permanent replacement of the population. Beyond this, the experience of the West seems to indicate an economic basis for the cyclical changes if not the long-run trends in controlled fertility. Thus if trends in fertility in Japan are contrasted with those in Western countries, interest is focused on the means whereby an educated people with high aspirations but low incomes can be induced to replace their numbers.

If trends in fertility in Japan are contrasted with those of neighboring agrarian societies, the interest is focused on the patterns, the motivations, and the means of the changing reproductive behavior. The research most significant for countries in which the high fertility of agricultural people still poses major problems would be intensive study of the declines in the fertility of the village women in the agricultural areas. If it is true, as present data suggest, that the agricultural people in the villages of Tohoku region are practicing family limitation through abortion and contraception, this is a highly significant fact in itself. Beyond this there should be careful study of the genesis of the psychological awareness and the firm motivations that led to actual limitation rather than merely expressions of desires to achieve limitation. The answers to these questions in previous studies of fertility have been in such economic terms as population pressure, low income, and low levels of living. The declines in fertility have occurred in negative rather than positive association with economic poverty, however, and the acceleration of the diffusion of practice has occurred with economic restoration and rising economic indicators, not with economic collapse, blocked migration to the cities, and declining *per capita* income.

Given knowledge of the social psychology of planned parenthood as reality in peasant society, there is a further need to know whether the relations were associated with the specific modernization of Japan or with specific aspects of the nonmaterial culture of that country.

Analysis of the implications of declining fertility among the Japanese for the future size and structure of the population of Japan is in process. In a sense population projections constitute such an analysis, for in all those made since the beginning of precipitant declines in fertility, the age pyramids of the future populations resemble those drawn for Western populations in the late 'thirties and the early 'forties.[32] The tools of modern demographic analysis permit a more ordered picture of the population structure and the population dynamics that are inherent in the future if present levels of fertility continue in force or if the downward movements continue.[33]

Research on the cultural and the social-psychological aspects of declining fertility in contemporary Japan has a dual relevance. From the standpoint of nations desiring to curb overrapid increase, here are studies in a nation in which decline has occurred. From the standpoint of the problems of Japan, study of the subjective correlates of decline is not unrelated to the estimation of the future of fertility and the evaluation of whether or when positive policies are indicated. Entirely aside from questions of policy for other countries or for Japan, the research of the Japanese on the changing fertility in their country has contributed to the world's fund of knowledge on human fertility and its variability.

[32] Tachi, Minoru; Ueda, Masao; and Takagi, Naobumi: Shōwa 24-nen yori Shōwa 90-nen ni itaru danjo nenrei gosai kaikyū betsu jinkō no suikei. [Projection of Population, 1950 to 2015, by Sex and Age.] Pp. 79–94 in: Nihon. Kōsei-shō, jinkō mondai kenkyūjo. *Chōso kenkyū shuyō kekka,* 1952. Tokyo, 1953. Also: Tachi, Minoru: Nihon no shōrai jinkō no ichi suikei. Pp. 47–50. An Estimate of Future Population of Japan. Pp. 50–53 in: Nihon jinkō gakkai. The Population Association of Japan: *Nihon jinkō gakkai kiyō. Archives of the Population Association of Japan.* Tokyo, 1954, 50, No. 3, 53 pp.

[33] Tachi, Minoru: Waga kuni saikin no shussei to shibō no hendō go jinkō kōzō ni oyobosu eikyō ni kansuru kenkyū. [On a Relation of the Recent Changes of Fertility and Mortality to the Sex-Age Distribution Population in Japan—in View of "Actual" and "Potential."] *Jinkō mondai kenkyū,* March, 1955, 60, pp. 1–74.

CONTRACEPTION AND CATHOLICISM IN PUERTO RICO

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PESSIMISTIC forecasts of continuing high rates of natural increase in Latin America are frequently based partly on the assumption that religion is a powerful force sustaining high fertility; positively in the sense of approval of increase and multiplication, negatively by means of taboos on most forms of contraception. Since the transformation of religious beliefs is seen as unlikely or as a slow process, little hope is placed in imminent fertility decline as a solution to overpopulation. In the light of the teaching of the Catholic Church with reference to birth control, and considering the power and pervasiveness of the Church in Latin America, the assumption seems plausible. Subject to question, however, is the assumption of correspondence between official doctrine and private belief and behavior.

The present paper attempts to show to what extent religion affects beliefs and behavior with respect to fertility and birth control in Puerto Rico. It draws on three different sample surveys: (1) A sample of 1,000 households, representative of the total universe of households in Puerto Rico. This sample is used in dealing with questions of incidence of birth control use. (2) A sample of 888 mothers of less than seven years of education, was drawn from Pre-Maternal (Birth Control) and general out-patient clinics in various parts of the Island. This group of cases is used for a more detailed examination of interrelationships. Because of the broader aspects of the study, this sample was not designed to be representative of the clinic population as a whole. It was drawn in such a way as to contain a roughly equal number of birth control users, never users, past users, and the sterilized. Stratification within these groups was

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done by age and residence. For this reason, this sample has not been used for data on the incidence of family limitation; and, as regards other types of data, wherever feasible the sample has been divided according to frequency of attendance of religious services.[4] (3) An intensively interviewed sample of seventy-two lower class women and their mates. This sample has been used for illustrative, qualitative purposes.

Of the sample of 888 mothers, 12.7 per cent are Protestants, 4.5 per cent Spiritualists, and 1.5 per cent claim no religion, making a total of 18.7 per cent of the sample who may be designated as non-Catholic. This is quite close to the figure of 17.3 per cent which Hatt found in his more representative sample of Puerto Rico in 1948.[5]

The two groups are similar in terms of education and residence. Median years of schooling is 3.7 for Catholics, 3.6 for non-Catholics. Fifty-seven per cent of the Catholics and 55 per cent of the non-Catholics are rural residents. Both because of the similarity of the two groups with respect to these important variables, and because of the paucity of non-Catholics in the sample, we have not attempted in this analysis to hold demographic factors constant. In many cases, however, we have divided the groups according to frequency of attendance at religious services.[6]

Let us first examine the relation between religion and certain attitudes toward family size. In Table 1, religion is cross-tabu-

[4] Although the sample was drawn from two different sources, for purposes of this paper there appears to be little relation between religion and the source of the sample; 70.5 per cent of Catholics and 63.8 per cent of the non-Catholics were drawn from the Out-Patient Clinics. This small difference may be partly compensated for by the fact that Catholics drawn from the Pre-Maternal Clinics attend church somewhat more regularly than those drawn from the Out-Patient Clinics. It is of interest that in the case of the non-Catholics, those from the Pre-Maternal Clinics attend church somewhat less regularly than those from the Out-Patient Clinics—another indication of the general hypothesis developed in this paper.

[5] Hatt, Paul K.: Backgrounds of Human Fertility in Puerto Rico (Princeton: Princeton University Press, 1952) Table 22, p. 38.

[6] The non-Catholic group in the sample attends services much more frequently than the Catholic. Sixty per cent attend at least once a month, whereas only 33.5 per cent of the Catholics attend as frequently as this. In both groups, the education of the more frequent attenders is somewhat higher. Infrequent Catholic attenders are somewhat more rural, but the reverse is true for non-Catholics.

lated with six items reflecting such attitudes. Four of the items refer to attitudes held earlier in the respondents marital histories, as recalled by the respondents, and two refer to current attitudes. For simplicity, a condensation of each question is given rather than the exact wording as used in the interview.

Looking first at the total column, we see that differences between Catholics and non-Catholics either do not exist or are in the unexpected direction. That is, non-Catholics are somewhat more likely than Catholics to have thought, before they began bearing children, about how many children they wanted; to have wanted a somewhat larger number of children; and currently to be more "large family minded." In general, these differences are maintained or enlarged when religious attendance is controlled. Moreover, frequency of attendance unexpectedly shows a positive relation to early concern about spacing and size of family, but appears associated in the expected fashion as regards early and current family size ideals and family mindedness.

Table 1. Various measures of family size ideals by religion and church attendance.

	Total		Frequent Attendance[1]		Infrequent Attendance	
	Catholic	Other	Catholic	Other	Catholic	Other
Per cent who Thought Favorably about Spacing, before Birth of First Child	45.5 (720)	43.0 (165)	50.8 (241)	46.5 (99)	43.0 (479)	38.0 (66)
Per cent who Thought about the Number of Children They Would Like to Have, before Birth of First Child	51.5 (720)	45.5 (165)	53.5 (241)	48.5 (99)	50.0 (479)	41.0 (66)
Number of Children Wanted, before Birth of First Child (Median)	2.98 (370)	3.41 (74)	3.12 (129)	3.5 (48)	2.93 (241)	3.3 (26)
After which Birth First Thought Had Enough Children (Median)	4.49 (604)	4.48 (126)	4.47 (182)	4.59 (73)	4.50 (422)	4.42 (53)
Current Ideal Family Size (Median)	2.98 (720)	3.03 (165)	3.22 (241)	3.33 (99)	2.90 (479)	2.74 (66)
Index of "Large Family Mindedness" (Higher Score Indicates More Large Family Minded.)[2]	5.69 (720)	6.19 (165)	6.14 (241)	6.63 (99)	5.51 (479)	5.43 (66)

[1] Frequent attendance means attendance from one to four times a month.
[2] The index is based on responses to four agree-disagree questions on family size, and roughly speaking, the intensity of agreement or disagreement.

	Total		Frequent Attendance		Infrequent Attendance	
	Catholic	Other	Catholic	Other	Catholic	Other
a. Per cent Responding "None" or "Only Those Whose Health Is Endangered."	14.5 (457)	17.9 (95)	21.5 (149)	20.4 (54)	11.0 (313)	14.6 (41)
b. Per Cent Who Would *Not* Advise Daughter	34.3 (465)	33.8 (95)	44.0 (152)	39.0 (54)	29.8 (313)	26.8 (41)

Table 2. Attitude toward birth control by religion and church attendance.

While perhaps unexpected these attitudes are not inconsistent with Catholic teaching which stresses the sinfulness of contraceptive means, rather than their end. Consequently, we should examine attitudes which are more specifically related to these means. Table 2 contains the partial distribution of responses to two questions: (a) Who do you think has the right to use birth control, all married couples, some married couples, or none? (If some) which ones? Those who cannot afford to have more children, or only those whose health is endangered by having more children? (b) If your daughter were about to be married, would you advise her to use birth control?

Looking first at Item a, row 1 we note both the low proportion of Catholics who feel opposed to birth control, and the absence of difference between Catholics and non-Catholics.[7] Although opposition is greater among Catholics who are more frequent attenders at church services, a corresponding rise in opposition is found among the non-Catholics.

Item b shows a similar lack of difference by religious groups as a whole, but when controlled for church attendance, Catholics emerge as slightly less willing to tell their daughters about birth control.[8] For both items, religious attendance seems of greater significance than affiliation.

[7] However, only a third of the table has been presented. Catholics are somewhat less likely to say "all married couples have the right to practice birth control" and somewhat more likely to say "those who cannot afford to have more children."

[8] Of course, responses to this item probably depend on feelings of modesty as well as on feelings with regard to birth control.

	Per Cent Who Have Ever Used Specified Method			
	Rhythm		Abstinence	
	Catholics	Non-Catholic	Catholics	Non-Catholic
Urban	25.3 (187)	36.4 (61)	22.4 (187)	18.2 (61)
Rural	18.7 (99)	15.5 (19)	17.4 (99)	31.0 (19)

Table 3. Use of natural methods among those who have ever used birth control, by religion and residence.

But opinions are one thing and behavior another. A good Catholic might not agree with the Church position on birth control, but might feel bound to observe the taboos in practice. Thus we must look to actual contraceptive practice for the real test of religious influence. In this case we are fortunate in being able to draw on data from a more representative sample.

In order to derive an estimate of birth control practice for the Island as a whole we included a number of questions in another survey in Puerto Rico which took a representative sample of 1,000 households on the Island. This sample indicated that among 54 per cent of the Island's urban Catholic families and 35.5 per cent of its rural Catholic families birth control has at some point been used.[9] These figures may seem quite striking when we consider the general poverty and low levels of education prevalent on the Island. But they are even more striking when we compare them with similar figures for non-Catholics. Only 54 per cent of the urban non-Catholic families and 27.5 per cent of the rural non-Catholic families have practiced birth control. Thus, in the urban area no difference by religion was found, and in the rural area the incidence of birth control is somewhat higher for Catholics than for non-Catholics.

However, the Catholic Church does not forbid all methods

[9] Holding residence constant no consistent relation between education and religious affiliation is apparent in this sample. However, in three of the four educational groups considered, the incidence of Catholicism is somewhat higher among rural than among urban respondents. In Hatt's sample an inverse correlation (−.16) was found between Catholic affiliation and urban residence. Hatt: *op. cit.*, Table 163, p. 199.

	Catholic	Non-Catholic
Urban	2.61 (173)	1.88 (60)
Rural	3.61 (97)	3.42 (22)

Table 4. Median birth after which birth control was started, among those who have ever used birth control, by religion and residence.

of birth control, and it is possible that Catholics are practicing approved methods of contraception. Table 3 shows that only a minority of the Catholics who have used birth control have ever used abstinence or rhythm. Especially striking again is the fact that urban non-Catholics have more frequently used rhythm than urban Catholics and that rural Protestants have more frequently used abstinence than rural Catholics. Other differences are slight.

It has been suggested that sterilization is popular in Puerto Rico because it involves sinning only once.[10] If this were true we would expect that among contraceptors, Catholics would be more likely to have used this method than non-Catholics. We find, however, that no difference exists. Among those who have ever practiced birth control, 36.4 per cent of the Catholic and 37.5 per cent of non-Catholic women are sterilized. However, it is true that somewhat more Catholics have been sterilized without previous experience with other methods. 76.8 per cent of the sterilized Catholic women, but only 66.8 per cent of the sterilized non-Catholic women have never used other methods.

But perhaps the variable of ever-use of birth control is too crude to detect differences in behavior. It might be the case that although Catholics are just as likely to try birth control as are members of other faiths, they are more likely to start them later in their marital history, use them erratically, or discontinue use of them after a trial period. Point of initiation of birth control practice is seen in Table 4.

[10] Senior, Clarence: Women, Democracy, and Birth Control. *The Humanist*, 5, 1952, pp. 223–224.

	Catholics Per Cent	Non-Catholics Per Cent
Started Before Reaching Optimum Number	49	47.2
Started Just After Reaching Optimum Number	27	28.7
Started Later Than Optimum	24	24.1
Total	100 (484)	100 (108)

Table 5. Point of initiation of birth control among those who have ever used birth control by religion.

In both urban and rural areas, but especially in the latter, Catholics contraceptors started using birth control somewhat later than Protestants.

Returning to our special sample, we have a more subjective measure of the point of initiation of birth control. Those respondents (92 per cent of the sample) who have more children than they consider ideal were asked at what point (in terms of birth order) they first felt they had enough children. These responses were then cross-classified with the point at which birth control was initiated. In this case, as seen in Table 5, no difference appears between the two groups.

Let us now consider regularity and length of use once birth control is initiated. Again no differences are apparent. 38.5 per cent of the Catholics are classified as irregular-short term users of birth control, and 38.1 per cent of non-Catholics are so classified. Table 6 shows the breakdown by frequency of church attendance.

Table 6. Length and regularity of use, by religion and church attendance.

	Per Cent Classified as Short-Term Irregular Users	
	Catholic	Non-Catholic
Frequent Attendance	26.5 (117)	35.4 (48)
Infrequent Attendance	44.0 (257)	41.6 (36)

	Per Cent Who Cite Religious Reasons	
	Catholic	Non-Catholic
Frequent Attendance	16.5 (97)	22.2 (36)
Infrequent Attendance	6.0 (215)	10.4 (29)

Table 7. Principal reason for not practicing birth control by religion and church attendance.

The Catholics who regularly attend church are the least likely of the four groups to have practiced birth control irregularly and for a short period. The converse, not shown in the table, is also true—they are most likely to have been long term regular users.

Thus far we have tacitly assumed that those Catholics who do not practice birth control are refraining because of religious taboos. But even this assumption is groundless. Of those 377 women who are currently not practicing birth control, only about one in ten cite religion as their principal reason for not doing so. Again the difference between Catholics and non-Catholics is contrary to expectation. Whereas 17 per cent of the non-Catholic non-users cite religion as their own or their husbands' principal objection, only 9.3 per cent of the Catholics give this reason.[11] Breakdown by frequency of church attendance shows a correlation in the expected direction, but the religious differentials are still maintained. (Table 7.)

That reasons other than religious account for failure to practice birth control is also shown in Table 8 which contains the distribution of responses to the question, "If there were a pill which was safe and which could be taken once a week to prevent having children, would you take it?" Again we see that church attendance rather than religious affiliation plays the larger role, but that in absolute terms, few respondents say they would fail to take the pill.

[11] Elsewhere, when asked why they did not initiate birth control at the point when they first thought they had enough children, 9.4 per cent of the Catholics and 9.1 per cent of the non-Catholics gave religious reasons.

	Catholic	Non-Catholic
Frequent Attendance	15.8 (95)	19.4 (36)
Infrequent Attendance	3.8 (211)	— (28)

Table 8. Per cent of non-users who would *not* take pill.

Summary

1. Despite the fact that over 80 per cent of the Puerto Rican population classify themselves as Catholic, attitudes and behavior are predominantly favorable to the small family achieved by non-Church methods of birth control.

2. Non-Catholics appear to be no more liberal in this regard than Catholics, and in some instances evidence patterns more usually associated with Catholics. The one possible exception refers to time of inception initiation of birth control practice.

3. Church attendance is usually, though by no means always, associated inversely with patterns favorable to birth control, but even among those who attend services frequently, attitudes and behavior are predominantly in the direction of rational achievement of small family goals.

How can we account for these anomalous findings?

First of all we should understand that in general Latin American Catholics do not take religion as seriously as do Catholics in certain other areas, especially where Catholics form a minority.[12] One must be a Catholic in Puerto Rico just as one must be a Republican in a small town of upper New York State, but the frequency of utterance of such phrases as "I am not a fanatic," and "I am religious in my own way" suggests that to take Church teachings too seriously in matters which affect private life may be taken to be a sign of mental weakness.

[12] In making a similar point, a Catholic demographer notes that ". . . the Latin American region is already 100,000 clergy short of the number required to provide religious service numerically comparable to the prevailing standards in the United States, England or Ireland." William J. Gibbons, in The Interrelations of Demographic, Economic, and Social Problems in Selected Underdeveloped Areas. New York, Milbank Memorial Fund, 1954, p. 176.

Moreover, whether as cause or effect of this religious indifference, Puerto Ricans are not much exposed to the teachings of the Church. According to data collected by Hatt in 1948, 70 per cent of the adult women and 80 per cent of the adult males never attend church services or attend only occasionally.[18]

While anti-clericalism is not of great significance, as indicated below in the comments by lower class Puerto Ricans, there is little inhibition in disagreeing with the Church.

> The Catholic religion says it's a sin to use birth control, but I think it's a greater sin if the children have nothing to eat.
>
> Possibly the Church is right, but since the poor are not able to support many children they have to disregard the position of the Church and make their own decision to use birth control. Personally I think it is not a sin.
>
> The Church forbids it but it is good to use birth control. The Church isn't going to support the children.

The occasionally greater conservation on the part of Protestants merits some comment. While it is quite possible that the unexpected relationships are due to uncontrolled variables, it is also true that in general religion is taken more seriously by Protestants than by Catholics in Puerto Rico. A minority group with a high proportion of converts, and with a much higher clergy-parishioner ratio than is true for Catholics, Protestants are both more fervid and subject to greater control by their church than is true for Catholics. Moreover, several of the smaller but rapidly growing sects in Puerto Rico emphatically oppose birth control. More intensive study of this minority is needed, but it may be the case too that they place more emphasis on large family ideals or that whatever emphasis exists is more effective.

Our limited research into only one institution might indicate that the intensive investigation of the content and meaning of the various fertility relevant institutions in a society could enhance the reliability of traditional population forecasting, especially where this involves cultures other than our own.

[18] Hatt, *op. cit.*, Table 23, p. 39.

SOCIAL AND PSYCHOLOGICAL FACTORS AFFECTING FERTILITY

XXXI. FEAR OF CHILDLESSNESS, DESIRE TO AVOID AN ONLY CHILD, AND CHILDREN'S DESIRES FOR SIBLINGS[1]

ERWIN S. SOLOMON, JEANNE E. CLARE, AND CHARLES F. WESTOFF[2]

WHEN the Study of Social and Psychological Factors Affecting Fertility was originally designed, a list of twenty-three hypotheses was formulated.[3] Most of these hypotheses deal with major variables such as socio-economic status, marital adjustment, interest in religion, etc., and their association with the degree of fertility planning and fertility. Some of the hypotheses, however, were restricted to variables which are more specific in nature in the sense of being confined to certain birth orders rather than to completed fertility. Two such hypotheses are:

A. The desire to insure against childlessness is an important reason for having a second child; and

B. The belief that an only child is handicapped is an important reason for having a second child.

It should be emphasized that both of these hypotheses relate only to the extent to which the fear of childlessness and the desire to avoid an only child are involved in the range of motivations affecting the desire to have a *second* child. A third hypothesis was stated in a more general form: C. "The interest of

[1] This is the thirty-first of a series of reports on a study conducted by the Committee on Social and Psychological Factors Affecting Fertility, sponsored by the Milbank Memorial Fund with grants from The Carnegie Corporation, New York. The Committee consists of Lowell J. Reed, Chairman; Daniel Katz; E. Lowell Kelly; Clyde V. Kiser; Frank Lorimer; Frank W. Notestein; S. A. Switzer; Warren S. Thompson; and P. K. Whelpton.

[2] From the Milbank Memorial Fund, the University of Michigan, and the Office of Population Research, Princeton University, respectively.

[3] *See* Whelpton, P. K. and Kiser, Clyde V.: Social and Psychological Factors Affecting Fertility. IV. Developing the Schedules and Choosing the Type of Couples and the Area to be Studied. The Milbank Memorial Fund *Quarterly*, October, 1945, xxiii, No. 4, pp. 394–396 (Reprint pp. 147–149).

children in, and their desire for, brothers and sisters affect the size of family."

Since most of the questions relating to Hypotheses A and B were asked of the couple about their last child, the analysis pertaining to the second child must be confined to two-child families. The general focus in this report, however, is restricted to these motivations only as they relate to having a second child and not to the two-child family *per se*. A subsequent article will be devoted to a comparison of the entire range of specific reasons motivating various birth orders with particular attention to the family-building process and the question of whether certain motivations for first and second pregnancies are "predictive" of differences in completed family size. This present article, to reiterate, is limited to the three hypotheses listed above.

The Data

The data to test these three hypotheses were collected in the Indianapolis Study in 1941 from a sample of "relatively fecund" couples meeting the following eligibility requirements: husband and wife native white, both Protestant, married during 1927–1929, neither previously married, husband under 40 and wife under 30 at marriage, both at least eighth grade graduates, and residents of a large city most of the time since marriage.

Since the main section of this paper deals with some specific motivations for wanting and having the second child, as reported subsequent to its birth, it was decided that the analysis should be confined to those couples who deliberately planned this child.[4] It is only within the group of couples who deliberately planned their second child that we have behavioral evidence of some motivation operating to cause the couples to interrupt contraception in order to conceive. The distributions of replies to all of the questions relating to reasons for having the second child and to the questions pertaining to the hy-

[4] This group consists of two fertility-planning categories: *Number and Spacing Planned*, which is the classification of couples with no pregnancies that were not deliberately planned by stopping contraception in order to conceive and *Number Planned*, which includes couples whose *last* pregnancy was deliberately planned by stopping contraception in order to conceive, but who had one or more previous pregnancies under other circumstances.

potheses were analyzed by planning status and it was found that virtually every analysis indicated statistically significant differences between those couples who planned their second child and those who did not[5]—a fact that reinforces the validity of analyzing the responses of the "planners" only.

The analysis concerning the two-child families will therefore be confined to the 239 couples with one child living at the conception of the last child who deliberately interrupted contraception in order to conceive this child. In order to obtain an evaluation of the relative importance of the two hypotheses factors with other considerations motivating couples to have a second child, the distribution of replies of wives and husbands to a multiple-choice listing of the three most important reasons for having the last child is presented in Table 1. Because of

Table 1. Per cent distribution of three most important reasons for encouragement in having the last child for couples with two children who planned the last child.

Reason Encouraged in Having Last Child	Wives			Husbands		
	First	Second	Third	First	Second	Third
Number of Couples[1]	233	233	233	237	237	237
Per Cent, Total	100.1	100.1	100.1	100.0	100.0	100.0
Not Wanting an Only Child	31.8	26.6	20.2	29.1	19.8	13.5
A Strong Liking for Children	41.6	12.0	10.7	38.8	13.9	13.5
A Feeling that Children Bring Husband and Wife Closer Together	8.2	17.2	14.2	13.1	24.5	19.8
The Desire of Children for More Brothers and Sisters	4.7	12.4	14.2	2.1	4.6	10.1
Not to be Left Childless in Case of Death of Only Child	1.7	12.0	11.2	0.0	7.6	13.1
Wanting a Girl if Only had Boys, or a Boy if Only had Girls	6.4	7.7	9.9	3.8	5.5	9.3
The Traditional Belief that Married Couples Ought to have Children	3.9	5.6	6.4	6.8	13.1	9.7
A Desire to See what Own Children Would be Like	0.9	3.0	8.6	0.8	5.5	4.2
A Belief that it is a Religious Duty to have a Family	0.9	2.6	2.1	4.2	3.8	1.7
A Feeling that it is Important to Carry on the Family Name	0.0	0.9	2.6	1.3	1.7	5.1

[1] Includes only couples who gave all three most important reasons; six wives and two husbands are excluded from the total.

[5] Statistical significance in this report implies $P \leq .05$.

our previous restrictions concerning the sample, these replies refer to reasons for having a planned last child for two-child families. It is clear that "not wanting an only child" (Hypothesis B) figures prominently as a major encouragement for having the second (last) child. It ranks second for both wives and husbands as the first most important reason for encouragement in having the second child; it ranks first among wives and second among husbands as the second most important reason, and first for the wives and tied for second for the husbands as the third most important reason. By comparison, the reason "not to be left childless in case of death" (Hypothesis A) appears to be of far less importance. As the first most important

Table 2. Per cent distribution of replies of couples to hypotheses questions for couples with two children who planned the last child.

Hypothesis A. "The desire to insure against childlessness is an important reason for having a second child."			Hypothesis B. "The belief that an only child is handicapped is an important reason for having a second child."		
Thought second a comfort if first died.[1]			Thought first affected by second.[3]		
	Wives	Husbands		Wives	Husbands
Number[5]	239	239	Number[5]	239	239
Per Cent, Total	100.0	99.9	Per Cent, Total	100.0	99.9
Very Seldom	15.1	23.8	Much Worse Off	2.1	0.8
Seldom	6.3	10.0	Somewhat Worse Off	1.3	2.5
Sometimes	21.3	18.4	Neither Better Nor Worse Off	7.5	6.7
Often	13.8	16.3	Somewhat Better Off	20.1	25.9
Very Often	43.5	31.4	Much Better Off	69.0	64.0
Encouraged to have last not to be left childless.[2]			Encouraged to have last to avoid only child.[4]		
Number[5]	233	235	Number[5]	235	233
Per Cent, Total	100.1	100.0	Per Cent, Total	100.1	100.1
Very Little	20.2	27.7	Very Little	4.7	3.4
Little	15.0	14.9	Little	5.1	5.2
Some	23.2	25.1	Some	11.1	20.6
Much	9.9	5.5	Much	11.1	21.5
Very Much	31.8	26.8	Very Much	68.1	49.4

[1] After your first child was born did you often think how much comfort a second child would be if the first died?
[2] How much were you and your husband (wife) encouraged to have your last child by the reason, if you had only one child, not to be left childless in case of its death?
[3] After your first child was born did you think he would be better or worse off if you had another child?
[4] How much were you and your husband (wife) encouraged to have your last child by the reason of not wanting an only child?
[5] Includes only couples with known replies.

reason for encouragement in having the second child it ranks seventh for wives and last for husbands (no husbands considered this the most important reason); it ranked in a tie for fourth among the wives and was fifth for husbands as the second most important reason and was third for wives and fourth for husbands as the third most important reason for encouragement in having the second child. It is pertinent to indicate that since most of these families presumably were planned as two-child families, the motivation of avoiding an only child is quite crucially focussed upon the having of the second child, probably more so than if these couples had planned to have additional children. Incidentally, it is of interest to note for the later analysis of total fertility that "the interest in and desire of the

Table 3. Per cent distribution of replies of couples to the indices for Hypotheses A and B for couples with two children who planned the last child.

HYPOTHESIS A. "The desire to insure against childlessness is an important reason for having a second child."

Rating of Extent Influenced in Having Second Child	Wives	Husbands
Number[1]	233	235
PER CENT, TOTAL	100.0	100.0
Very Little	12.4	23.0
Little	12.0	10.2
Some	28.8	29.4
Much	13.3	14.0
Very Much	33.5	23.4

HYPOTHESIS B. "The belief that an only child is handicapped is an important reason for having a second child."

Rating of Extent Influenced in Having Second Child	Wives	Husbands
Number[1]	235	233
PER CENT, TOTAL	100.0	99.9
Very Little	0.0	0.0
Little	1.3	1.7
Some	14.9	13.3
Much	11.5	19.7
Very Much	72.3	65.2

[1] Includes only couples with known replies to both questions from which index was constructed.

first child for a sibling" is of relatively little importance as an inducement to parents to have a second child.

There were two multiple-choice questions designed for each of the hypotheses. Table 2 includes the distributions of replies of wives and husbands to these four questions. The presumptive unidimensionality of the pairs of questions for the hypotheses was supported by the interrelationships among the four items. We can be reasonably confident that the pairs of questions are measuring the same motivation and that these are different from each other. Therefore, the pairs of questions were combined into single indices for each hypothesis, which simplifies the analysis as well as increases the reliability.[6]

The distributions of replies of wives and husbands for the two indices are presented in Table 3. An internal comparison of the replies again demonstrates that the "avoidance of an only child" is the most important of the two reasons cited for having a second child. Nearly three-fourths of the wives and two-thirds of the husbands state that they were "very much" influenced in having their second child for this reason. Not a single individual reported this reason to be of "very little" influence. One-third of the wives and one-fourth of the husbands report having been "very much" influenced to have a second child "by a desire to insure against childlessness."

These general findings are quite consistent when compared with the distributions revealed in Table 1, that is, the avoidance of an only child is of paramount importance while the fear of childlessness is considerably less important as a reason for having the second child. In the more detailed analysis of the two hypotheses dealing with the second child, below, an attempt will be made to examine some factors thought to influence the variability of responses.

The Desire to Insure Against Childlessness

The positive statement of this hypothesis presupposes that a second child is motivated by the parents' fear of being left with-

[6] In constructing the indices, the five categories of each question were scored from 0 to 4 and the pairs of questions were cross-tabulated and the scores were summed. This yielded nine classes which were then reduced to five.

out any children in the event the first child should die. The underlying factor seems to be the degree that the couple fears the possible death of the first child. It is obvious that these couples did desire children since they had deliberately planned the second child. The *post factum* shortcomings of the data are especially felt in a discussion of this particular hypothesis because it can be assumed that at the time of the conception of the second child, with one child living, the conscious fear of the first child dying was remote. How much *more* remote this fear was when the couples were questioned *after* the birth of the second child can only be conjectured.

It has been indicated already that the desire to insure against childlessness is a relatively unimportant reason for having a second child. From Table 3 it can be seen that about 47 per cent of the wives and 37 per cent of the husbands cite this factor as having influenced them "much" or "very much" in having their second child. Since this motivation implies the fear of the first child dying, those couples who have had the experience of a child dying before obviously would be more aware of this possibility than those without such experience.

There were only ten couples among this group who actually had the previous experience of the death of a child, seven of whom said that they were "much" or "very much" influenced in having their second child by the desire to avoid childlessness. There were 40 couples, moreover, among whom the wives had three or more pregnancies in order to have two children. These couples experienced a loss through death (the 10 couples above), miscarriage, or still-birth and thus this group had experiences which should have made the thought of the possible loss of a child more prominent in their minds than the other couples. Of these 40 women, 60 per cent stated they were influenced "much" or "very much" by the fear of childlessness while 44 per cent of the women who experienced no loss so answered. The husbands of these women manifested no such differences. In general, the differences observed are not as great as might be expected by *a priori* reasoning.

Another factor thought to influence the "fear of childlessness" as a motivation for having the second child was the health of the first child. One might anticipate that couples whose first child was in poor health would be more concerned about possible childlessness, although it is recognized that there may be a wide gap between poor health and conscious parental fears of death. The health ratings of the first child consist not of detailed histories of illnesses but of the mother's rating of the health of the first child "in infancy" (under 2 years of age) and "since infancy." The ratings of the health of the first child both in infancy and since infancy are very high. An average health index for the first child was constructed by combining the two ratings of health "in" and "since infancy."[7]

The Pearsonian coefficients of correlation between these health ratings and the replies of wives and husbands concerning the degree to which they were encouraged in having their second child by the desire not to be left childless (Hypothesis A Index) are all within the range of ± .05 in magnitude. It is obvious from these non-significant values that the wife's perception of the health of her first child is not related to this variable, a fact that raises the possibility of a neurotic component in this related fear of childlessness for some of those persons who do cite this as an important reason. It is clear that the actual relationship, if any, that does exist between the health of the first child and the possibility of its death is not explicitly a motivational factor in the

[7] They are distributed as follows:

	Health In Infancy Per Cent	*Health Since Infancy Per Cent*	*Health Index Per Cent*
Number	235	233	233
Per Cent, Total	100	101	99
Excellent	63	48	44
Very Good	16	23	29
Good	11	18	6
Fair	7	9	11
Poor	3	3	9

For a detailed discussion of the health ratings and their relation to fertility *see:* Herrera, Lee F. and Kiser, Clyde V.: Social and Psychological Factors Affecting Fertility. XIII. Fertility in Relation to Fertility Planning and Health of Wife, Husband, and Children. The Milbank Memorial Fund *Quarterly*, July, 1951, xxix, No. 3, pp. 331–376 (Reprint pp. 575–620).

minds of the parents when they reconstruct their reasons for having a second child.

Desire to Avoid Having an Only Child

The desire to avoid having an only child is by far the most important reason for having a second child among the three hypotheses under consideration. It is evident that having an only child is considered disadvantageous among the general population. A recent public opinion poll indicated that 75 per cent of the general public consider "being an only child a disadvantage."

Although this is such a widespread "reason" for having a second child, some factors were expected to influence the proportions of couples who state that this reason influenced them "very much." Assuming that only-child families are conceived to be handicapped, we might assume that families who had more contact with only-child families would be more conscious of the attendant liability. There is evidence, for example, of a higher incidence of only-child families among the higher socio-economic groups.[8] For this reason, socio-economic status[9] (SES) was considered. (*See* Table 4.) It appears that both wives and husbands in the "high" socio-economic group are most concerned with avoiding an only child, which is possibly a manifestation of the greater awareness through education of the problematic potential of only-child families.

If the aversion to having an only child is increased by ex-

[8] The proportion of native-white, ever-married women in 1940 (the time of the present study) living in cities of 250,000 or more population, 40–44 years of age, who had only one child was 14 per cent for those who paid less than $5.00 per month for rent and 25 per cent for those who paid $100.00 and over. Computed from Table 57, United States Bureau of the Census: Population, Differential Fertility, 1940 and 1910, Women by Number of Children Ever Born. Washington, Government Printing Office, 1945, pp. 178–179.

[9] The index of socio-economic status of the couple is derived from the equally weighted factors of the average annual earnings of the husband since marriage, monthly rental value of the home at interview, net worth of the couple, husband's longest occupation since marriage, purchase price of car, education of the husband and wife, and score on Chapin's Social Status Scale. For further description, *see* Kiser, Clyde V. and Whelpton, P. K.: Social and Psychological Factors Affecting Fertility, IX. Fertility Planning and Fertility Rates by Socio-Economic Status. The Milbank Memorial Fund *Quarterly*, April, 1949, XXVII, No. 2, pp. 214, 216, 244. (Reprint pp. 385, 387, 415).

Index of Socio-Economic Status	Wives		Husbands	
	Per Cent Base	Per Cent	Per Cent Base	Per Cent
Total[1]	235	72.3	233	65.2
0–1 (High)	55	89.1	51	90.2
2–3 (Medium)	102	67.6	102	52.0
4–6 (Low)	78	66.7	80	66.3

[1] Includes only couples with known replies.

Table 4. Proportion of couples "influenced very much" in having their second child by the belief that an only child is handicapped, for couples with two children who planned the last child by the socio-economic status of the couple.

perience, one might expect the number of siblings of the parents to affect their attitudes toward having an only child themselves. The proportions of wives and husbands influenced "very much" in having their second child in order to avoid having an only child by whether or not they were only children themselves and whether or not their spouses were only children is presented in Table 5. It is evident that the wives and husbands who themselves were only children do not consider this factor a great handicap; at least the proportions influenced "very much" in having their second child for this reason are not greatly affected by whether or not they themselves were only children. The proportions so influenced, however, are greater for those whose

Table 5. Proportion of couples "influenced very much" in having their second child by the belief that an only child is handicapped, for couples with two children who planned the last child, by whether or not the respondent was an only child and whether or not the spouse was an only child.

Rated as Influenced Very Much	Wives		Husbands	
	Per Cent Base	Per Cent	Per Cent Base	Per Cent
Number of Sociological Siblings of Respondent[1]				
None	22	77.3	34	55.9
One or More	209	72.2	199	66.8
Number of Sociological Siblings of Respondent's Spouse[1]				
None	38	81.6	22	81.8
One or More	197	70.6	207	64.7

[1] Includes only couples with known replies

spouses were only children. It might be reasoned, although these differences are not statistically significant, that individuals who were only children themselves do not consider this situation a great handicap with respect to feelings toward their own offspring, whereas they might attribute faults perceived in their spouses to this type of environment.[10]

Children's Interests in and Desires for Siblings

The third hypothesis under consideration is (Hypothesis C) "the interest of children in, and their desire for, brothers and sisters affects the size of family." The analysis of this hypothesis, by definition, has to be restricted to couples with at least one child living at the time of the last conception.[11] The couples did, of course, have varying numbers of previous children. The sample was restricted further to couples whose last conception was planned, for the same reason that the analysis of Hypotheses A and B were confined to this group—namely, that it is meaningless to attach the same significance to reasons offered by people for rational behavior with the "reasons" offered by couples for behavior that was admittedly "accidental." The effect of these two restrictions is to contract the range of fertility variation and to minimize the possibility of finding significant differences in fertility due to childrens' desires for siblings, or for that matter for any other variable.

Nevertheless, some minimal analysis was attempted. A tabulation was prepared for the purpose of assessing the significance of this motivation as one of the three most important reasons for having the last child, as compared to nine other reasons.[12]

[10] It was impossible to combine the only-child wives with the only-child husbands for further analysis because of the complete lack of correlation between the number of sociological siblings of wives and husbands. The Pearsonian product moment correlation for the sample under study was found to be −.01.

[11] It was found that for all couples in the Study the parents' replies indicated that the families with one child (no children living at the conception of the last child) manifested the greatest interest in and desire for siblings. Since these couples had no subsequent children, it is impossible to investigate the relationship between these interests and desires and the fertility of the couple. This suggests that (1) there was no demonstrable effect, and; (2) the only children were the most frustrated in terms of desires for siblings.

[12] *See* Table 1 for the identification of the ten reasons.

The "desire of children for brothers and sisters" ranked only sixth and seventh for wives and husbands as a first most important reason for having the last child (reported by only 5 and 2 per cent of wives and husbands respectively); it ranked fourth for the wives and seventh for the husbands as the second most important reason (offered by 11 per cent of wives and 6 per cent of husbands); and ranked third for the wives and fifth for the husbands only as the third most important reason. (15 per cent for wives and 11 per cent for husbands.) In comparison with the others, this particular reason is not cited as a very important one for having the last child.

Table 6. Per cent distributions of replies of couples to questions designed for Hypothesis C. "The interest in and desire of children for more brothers and sisters affects the size of family" and to the Hypothesis C Index for couples with two or more children who planned the last child.

	Extent Children Wanted More Siblings[1]		Extent Encouraged to Have Last Child by Desire of Children[2]	
	Wives	Husbands	Wives	Husbands
Number[3]	300	300	300	298
Per Cent, Total	100.0	99.9	100.0	100.0
Very Little	21.3	30.3	23.3	33.6
Little	15.3	12.0	13.7	18.1
Some	32.7	33.3	32.0	29.2
Much	8.7	11.3	8.7	7.7
Very Much	22.0	13.0	22.3	11.4

Hypothesis C Index

Rating of Extent Influenced in Having Last Child	Wives	Husbands
Number[4]	300	298
Per Cent, Total	100.0	100.0
Very Little	21.7	27.5
Little	21.3	25.2
Some	22.3	25.8
Much	16.7	12.8
Very Much	18.0	8.7

[1] How much have your children wanted more brothers and sisters?
[2] How much were you and your husband (wife) encouraged to have your last child by the reason of the desire of your children for more brothers and sisters?
[3] Includes only couples with known replies.
[4] Includes only couples with known replies to both questions from which index was constructed.

Two multiple-choice items were formulated to measure the extent to which childrens' interests in and desires for siblings influenced their parents to have another child. These were: "How much have your children wanted more brothers and sisters?" and "How much were you encouraged to have your last child by the reason of the desire of your children for more brothers and sisters?" An index was constructed from the replies to both of these items following the procedure and meeting the standards described earlier. It is apparent from the distributions in Table 6 that although there is some indication that children had wanted brothers and sisters, there is little evidence of this factor exerting much influence on parents to have their last child.

The ultimate test of the hypothesis, however, is whether or not couples who reported that this was one of the three most important reasons for having their last child and who replied that they were positively influenced by their children's interest in and desire for siblings actually exhibited fertility differences compared to other groups. The evidence from Tables 7–8 clearly demonstrates that the hypothesis is unsupported. According to these data, children's interests in and desires for sib-

Table 7. The proportion of wives and husbands listing "the desire of children for more brothers and sisters" as one of the three most important reasons for having the last child, and the proportion of total births contributed by these couples.[1]

The Desire of Children for More Brothers and Sisters	First		Second		Third	
	Wives	Births	Wives	Births	Wives	Births
Per Cent Giving Indicated Reason	5.1	5.2	10.6	10.7	15.0	15.5
Per Cent Base[2]	274	619	274	619	274	619
	Husbands	Births	Husbands	Births	Husbands	Births
Per Cent Giving Indicated Reason	2.2	2.1	5.5	5.8	11.3	11.5
Per Cent Base[2]	274	619	274	619	274	619

[1] Couples with one or more children living at the planned conception of the last live birth.
[2] Excludes eight couples with one child living and the wife pregnant at interview.

Rating of Extent Influenced in Having Last Child	Wives		Husbands	
	Number	Rate	Number	Rate
All Couples[1]	294	235	294	235
Very Little	65	234	82	212
Little	64	225	75	256
Some	67	248	73	234
Much	48	238	38	253
Very Much	50	232	26	227

[1] Includes only couples with known replies.

Table 8. Births per 100 couples by replies rated on index of influence in having last child by "the interests and desires for siblings of children" for couples with two or more live births who planned the last child.

lings have no significant effect on the fertility of their parents.[13] In Table 7 this is apparent from the negligible differences between the proportions claiming this motivation as the first, second, and third most important reason for having the last child and the proportion of total births contributed by these

[13] There is probably a selective factor operating which prevents adequate analysis with the available data. If it is assumed that children's desires for siblings could influence their parents to have another child it should also be assumed that these desires and this influence itself is dependent upon the number of children at the time of the subsequent conception. That is, the greater the number of children the less the likelihood of desire for siblings and the less the effect of these desires upon the parents. The data available for the present analysis pertains only to the last birth; a more reasonable test of the hypothesis would be to analyze the children's desires for siblings and its effect upon parents for each successive birth, controlled by the number of previous children. An indication of the comparative importance to the parents of the first child's desires for siblings upon the having of the second child can be found in Table 1. As the first of the three most important reasons for having the second child, it ranked fifth for wives and seventh for husbands; as the second most important reason it ranked third for wives and eighth for husbands, and was tied for second among wives and ranked fifth for husbands as the third most important reason for having the second child. The effect upon the size of family, of course, cannot be measured since these are all two-child families. Another factor to be considered in the analysis of the influence of the first child's desires for a sibling upon his parents having a second child is the age of the first child at the time of the conception of the second child. Effective verbal communication between the child and his parents probably does not commence until the child is three years old. It was found that among the two-child families who planned the last child, 66 per cent of the wives and 53 per cent of the husbands whose first child was three years old or more at the conception of the second child were rated as having been influenced "some," "much," or "very much" in having the second child by the interests and desires of the first child for siblings. By comparison, 35 per cent of the wives and 31 per cent of the husbands whose first child was under three years old at the conception of the second were so rated. This suggests that the desires of the first child for siblings may influence the parents in having a second child, especially where verbal communication is present. Unfortunately, the *ex post facto* design prevents successful analysis of the effect upon *total* fertility.

Rating of Extent Influenced in Having Last Child		Number	Rate
Total Couples[1]		292	236
Wives	Husbands		
Very Little or Little	Very Little or Little	84	223
Very Little or Little	Some, Much, or Very Much	43	244
Some, Much, or Very Much	Very Little or Little	73	245
Some, Much, or Very Much	Some, Much, or Very Much	92	236

[1] Includes only couples where joint replies are known.

Table 9. Births per 100 couples by joint replies rated on index of influence in having last child by the interests and desires for siblings of children for couples with two or more live births who planned the last child.

couples. Fertility rates are presented by the hypothesis index in Table 8 and it is clear that no systematic differences appear. One further test of the hypothesis was attempted by cross-classifying wives and husbands by their index categories in order to examine whether couples in which both spouses gave positive replies differed in their fertility from couples who agreed that they were influenced little by their children's desires for siblings (*see* Table 9). Again, the evidence suggests a lack of any significant or systematic fertility differences.

The only conclusion that can be reached from this analysis is that children's interests in and desires for siblings is inconsequential in its effect upon fertility behavior. This must be qualified in the sense that the refinement of the sample seriously restricts the range of fertility variation so that large fertility differences could not have been expected under any circumstances.

Summary and Conclusions

Three of the original hypotheses from the Indianapolis Study were analyzed in this report. The first two specifically refer to the having of a second child and the third is concerned with total fertility. They are:

A. The desire to insure against childlessness is an important reason for having a second child.

B. The belief that an only child is handicapped is an important reason for having a second child.

C. The interest in and desire for brothers and sisters affects the size of family.

It was found that Hypothesis B, "The belief that an only child is handicapped is an important reason for having a second child," is a major reason for having the second child for all of the couples included in the analysis. The importance of this motivation is somewhat greater for those couples who presumably had secondary contact with only-child families, that is, those classified as members of the "high" SES level and those whose spouses were only children, although it is cited as a major reason by virtually all of the couples. By comparison, Hypothesis A, "The desire to insure against childlessness is an important reason for having a second child," was determined to be of only minor importance by the replies of the couples. There is some differentiation within the sample of the significance of this motivation for having a second child, notably that it is of greater importance in the case of couples with some previous experience or conscious awareness of the possibility of being left childless (the questions were asked *after* there were two living children), although in no case can it be inferred that the data support the hypothesis that this is a major reason for having the second child.

The third hypothesis discussed, Hypothesis C, "The interest in and desire for brothers and sisters affects the size of family," appears to be of no importance in having the last child. There are no observable differences in the fertility behavior of couples who cite this reason as having been of positive influence. Moreover, the proportions that report this reason as of primary importance are negligible.

In general, therefore, it may be inferred that Hypothesis A is supported only to a slight extent. This hypothesis as stated cannot, of course, be negated except in comparative terms and the number of reasons for having the second child is consider-

able. In other words, the final evaluation of its importance has to be somewhat arbitrary.

Hypothesis B appears fully supported, in so far as the comparisons of this with other reasons are possible with the available data. It is evident that the desire to avoid having an only child is a most important reason for having the second child. It ranks at the head of the three most important reasons listed and a large majority report themselves as having been "very much" influenced in having their second child for this reason. No doubt part of the popularity of this reason is due to the almost "cliché" nature of the feeling in modern child psychology doctrines.

The wording and implications of the third hypothesis investigated permits a workable method of testing whether or not "The interest in and desire of children for brothers and sisters 'affect' the size of the family." That is, an examination of fertility rates by how couples reported having been influenced by this factor permits some assessment of its importance. In other words, is there any variability in fertility attributable to the expressed attitudes concerning this reason; is this motivation a source of differential fertility? The answer is clearly negative. There are no meaningful differences in the number of children born to couples that state this reason as the first, second, or third most important for having the last child, or who report that they were positively motivated by a consideration of this factor.

All three of the hypotheses analyzed refer to motivations as they reportedly affect behavior. For the first two hypotheses, the object was to determine the extent to which two selected reasons affected the having of a second child. The third hypothesis was designed to explore the effect of a specific motivation on size of family. Since these data are *ex post facto* we were, in effect, examining the "importance" of reasons for having a child *after* the child was already born. Therefore, we cannot actually ascertain the "effect" of any of the particular reasons upon having the child. All that we are measuring is the

parents' stated recollections of reasons for having done something that had been, in fact, accomplished prior to the time the questions were asked. Thus, a cause-effect conclusion is precluded. It is only by inference that we can suggest the possible effects of the reasons cited.

This problem simply underscores the general limitations of the *ex post facto* dilemma which has so often plagued interpretations of the Indianapolis data. This problem is compounded by the use of the multiple-choice questionnaire technique which is particularly vulnerable in the analysis of motivations, since it ignores the fact that motivations are extraordinarily complex in both range and intensity and may frequently involve subconscious levels.

MORTALITY DECLINES AND AGE DISTRIBUTION[1]

GEORGE J. STOLNITZ[2]

I

RECENT interest in the effects of mortality trends on age structure stems from several sources. In many underdeveloped areas spectacular mortality declines since the war have been accompanied by little or no change in fertility. To what extent movements in the death rate tend to raise or lower the relative size of different age classes has an obvious bearing on such questions as the prospective burdens of dependency in these areas, their forseeable rates of saving and investment, and fiscal or other social policies. A second stimulus has come from growing concern over the so-called "aging" of Western populations. According to the traditional view, this development has been the result of long-run downtrends in both mortality and fertility. Recognition in the last few years that the two movements have tended more to offset than to reinforce each other has focused fresh attention on the role of mortality *per se*. Probably a third reason for this interest has been the difficulty of forecasting even the direction of fertility changes in many parts of the world. A frequent expedient in current population projections is to hold fertility constant for "illustrative" purposes, thereby in effect examining mortality changes in isolation. At the same time, the need for more refined evaluation of public health programs and the expansion of social security systems have also activated research along these lines.

The purpose of this paper is to present a general approach to the age mortality problem. In particular, it will be seen that mortality changes tend to have rather limited effect on age

[1] The idea for this paper originated at the 1955 annual conference of the Merrill Center for Economics, where a group of distinguished economists patiently—and vainly—sought enlightenment from the author on the interrelations between vital trends, age composition and economic growth.

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structure. This conclusion has been reached in several studies, but always in connection with specific numerical illustrations only or with special population models.[3] The underlying structure of the probable relations between mortality movements and age in any population has apparently never been investigated.

II

For simplicity all vital events and censuses may be supposed to occur at mid-year, so that the relevant age distributions involve the exact ages 0, 1, . . . (Births and deaths in any census year are assumed to occur "just before" the census.) This is mainly to avoid having to deal with continuous variables; at the same time, no loss of essentials is entailed. A further advantage is that we can make use of exact-age survival rates (the p_x values of the life table), which are more readily available than the corresponding rates for age spans (L_x values). Migration is excluded and constancy of fertility is interpreted in its most usual sense, as unchanging age-specific rates among females. As will be seen, it is convenient to begin by considering females; the corresponding conclusions for males can be readily established later.

[3] *See* Bourgeois-Pichat, J.: Charges de la population active. *Journal de la Société Statistique de Paris,* 91, Nos. 3–4 (March–April, 1950), pp. 94–114; Valaoras, V. G.: Patterns of Aging of Human Populations, in Eastern States Health Education Conference, THE SOCIAL AND BIOLOGICAL CHALLENGE OF OUR AGING POPULATION, New York, Columbia University Press, 1950, pp. 67–85; Lorimer, F.: Dynamics of Age Structure in a Population with Initially High Fertility and Mortality. *Population Bulletin of the United Nations,* (Dec., 1951), No. 1, pp. 31–41; United Nations Population Division: Some Quantitative Aspects of the Aging of Western Populations. *Population Bulletin of the United Nations,* No. 1 (Dec., 1951), pp. 42–51; Dorn, H. F.: Prospects of Further Decline in Mortality Rates. *Human Biology,* December, 1952, 24, No. 4, pp. 235–261; Notestein, F. W.: Some Demographic Aspects of Aging. *Proceedings of the American Philosophical Society,* 98, No. 1 (Feb. 15, 1954), pp. 38–45; Sauvy, A.: Le viellissement des populations et l'allongement de la vie; *Population,* October–December, 1954, 9, No. 4, pp. 675–682; Mortara, G.: Sulla dipendenza della composizione per età di una popolazione dalla mortalità. *Giornale Degli Economisti E Annali di Economia,* January–February, 1955, 14 (New Series), Nos. 1–2, pp. 1–32; United Nations Population Division: The Cause of the Ageing of Populations: Declining Mortality or Declining Fertility? *Population Bulletin of the United Nations,* Dec., 1954, No. 4, pp. 30–38; Coale, A. J.: The Effects of Changes in Mortality and Fertility on Age Composition. Milbank Memorial Fund *Quarterly,* Jan., 1956, 34, No. 1, pp. 79–114.

Parts of the following discussion draw on some suggestions in the last two sources.

Let N_i denote an initial number of persons at age i, i = 0, 1, ... Then the population's age distribution is described by the proportions $\frac{N_i}{\Sigma N_i}$. To examine the effects of changing mortality on the distribution at later dates, we first have to define the situation that would have developed under no change. Obviously we can think of values $f_i(t)$, such that $N_i f_i(t)$ would be the number aged i at time t if mortality remained constant after time 0. Letting $c_i(t)$ denote the corresponding age proportions, we have

$$(1) \quad c_i(t) = \frac{N_i f_i(t)}{\Sigma N_i f_i(t)}$$

It will be observed that no restrictions are placed on the demographic background leading up to the initial numbers and none on how age composition would vary over time, given a continuation of the original vital rates.

Suppose instead that survival rates changed "just after" the initial date, and that the new rates continued thereafter. (The effects of successive changes will be considered below.) Then $f_i(t)$ and $c_i(t)$ would be replaced by new values $f_i'(t)$ and $c_i'(t)$, where

$$(2) \quad c_i'(t) = \frac{N_i f_i'(t)}{\Sigma N_i f_i'(t)}.$$

The problem of examining the effects of the given change on age structure may be formulated as follows: How and by what orders of magnitude are $c_i(t)$ and $c_i'(t)$ likely to differ at various times t?[4] More specifically, what sorts of differences can be expected at the pre-adult, adult, and advanced ages, both in the short-run and over longer periods?

[4] Comparisons between $c_i'(t)$ and the original age proportions $\frac{N_i}{\Sigma N_i}$ may be of interest for some purposes but not for the problem at hand. Any actual population would show variations in age structure for some time after all vital rates became fixed. The need for distinguishing between possible comparisons has often been overlooked in the literature, largely because of the tendency to focus on special population types. For example, if the original population were assumed to be stable, $f_i(t)$ would equal e^{rt} for each age i, $\frac{N_i f_i(t)}{\Sigma N_i f_i(t)}$ would equal $\frac{N_i}{\Sigma N_i}$, and the two sets of proportions could be used interchangeably.

The first point to be made is that the measures of mortality change which are relevant for these questions are the proportionate variations in survival rates. Let p_i denote the original rates and p_i' the new ones, and consider any of the initial numbers N_1. The number surviving to time 1 under the original rates would be N_1p_1 and under the new rates N_1p_1'; hence the ratio of the second to the first group of survivors would be $\frac{p_1'}{p_1}$. The corresponding numbers in the total population would be $B_1 + \Sigma N_1p_1$ and $B_1' + \Sigma N_1p_1'$, where B_1 and B_1' represent the births occurring between times 0 and 1 under the alternative mortality conditions. Since $B'_1 + \Sigma N_1p_1'$ can be rewritten as $\frac{B_1'}{B_1} B_1 + \Sigma N_1 \frac{p_1'}{p_1}p_1$, the ratio of this to $B_1 + \Sigma N_1p_1$ is the mean of the ratios $\frac{p_1'}{p_1}$ and $\frac{B_1'}{B_1}$.[5] Moreover, $\frac{B_1'}{B_1}$ is an average of the relative survival changes in the reproductive ages, so that the ratio of total numbers reduces, more simply, to the mean of the various $\frac{p_1'}{p_1}$.[6] Thus, whether the fraction of the population at a given age increased or decreased $[c_1'(1) \gtrless c_1(1)]$, and the extent of the shift, would depend on how the relative survival change at that age compared with the average relative change for the population as a whole.[7]

The relations between $c_1'(t)$ and $c_1(t)$ at any later year

[5] The situation is exactly the same as in deriving the average of n values $v_1, \ldots, v_n$, with respective frequencies $h_1, \ldots, h_n$. The mean $v = \frac{\Sigma v_i h_i}{\Sigma h_i}$ where the v_i correspond to the above $\frac{p_1'}{p_1}$ and $\frac{B_1'}{B_1}$ and the h_i to N_1p_1 or B_1.

[6] Let m_i denote the age-specific fertility rates of persons aged i. Then $B_1 = \Sigma N_{i-1}p_{i-1}m_i$ (where i ranges from about 15 to 49) and $B_1' = \Sigma N_{i-1}p_{i-1}'m_i = \Sigma \frac{p_{i-1}'}{p_{i-1}} N_{i-1}p_{i-1}m_i$. For convenience we shall assume that the female reproductive span begins at 15 and ends at 44, fertility rates at other ages being universally negligible.

[7] In the particular case of the proportions at age 0, $c_0(1)$ and $c'_0(1)$, the corresponding comparison would involve the average change over the reproductive span, rather than for a single age. *See* the preceding footnote.

would be entirely analogous, except that the relative survival changes would be compounded. This is merely a result of the fact that the numbers by age and in the total population would reflect the new survival chances over lengthening intervals of ages. For example, at time 2 the group originally aged i would have either $N_ip_ip_{i+1}$ or $N_ip_i'p'_{i+1}$ survivors under the alternative rates; similarly, the total population would number $B_2 + B_1p_0 + \Sigma N_ip_ip_{i+1}$ or $B_2' + B_1'p_0 + \Sigma N_ip_i'p'_{i+1} = \frac{B_2'}{B_2}B_2 + \frac{B_1'p_0'}{B_1p_0}p_0 + \Sigma\frac{p_i'p'_{i+1}}{p_ip_{i+1}}N_ip_ip_{i+1}$. The ratio $\frac{B_2'}{B_2}$ would be an average of the values of $\frac{p_i'p'_{i+1}}{p_ip_{i+1}}$ in the reproductive ages and $\frac{B_1'p_0'}{B_1p_0}$ would also be a product of two relative survival changes. Accordingly, the ratio of $c_i'(2)$ to $c_i(2)$ at each age could be expressed in terms of such products. At time 3 the relevant variables would be products of three relative changes, at time 4 of four changes, and so on.

It follows that age distribution is unaffected, i.e., $c_i'(t) = c_i(t)$, when the relative changes in survival rates are the same at all ages. Since any average of a group of values, all of which are equal, is the same value, the total population would be changing in the same proportion as the number at each age. This is perhaps so obvious as to require no further explanation, but it is also interesting to see some of the demographic details. Let $p_i' = p_i(1+k)$; that is, suppose the proportionate change k were independent of age. Then at time 1 the survivors of each of the original age groups would be $(1+k)$ times as numerous as under constant mortality. Since age-specific fertility is assumed to be fixed, the births between times 0 and 1 (hence the "census" number aged 0 at time 1) would also be altered in this proportion, as would the total population. A year later each of the groups aged 2 and over would have had two years of changed survival chances and would be $(1+k)^2$ as numerous. The number aged 1 would have been altered by a factor of $(1+k)$ because of the changed number of births a year before,

and again by this factor in passing through the first year of life. Finally, the births between times 1 and 2 would have been affected in the same proportion as the numbers in the parental ages. And in general, at each date t the numbers by age and thereby the total population would change by $(1 + k)^t$.[8]

Until now no restrictions have been placed on the nature of the survival changes. A second basic point to note is that the changes which are analytically interesting are increases rather than decreases and of the kinds corresponding to trends rather than to annual variations. Both restrictions have in fact been universally presupposed in the literature, although more often implicitly than explicitly. They will also be assumed here. One reason is that, since sustained survival downtrends have never been documented, investigation of their effects on age composition would have only curiosity value.[9] Another is that the age patterns of change tend to be erratic so long as survival chances are generally falling or, even if rising, when the changes are over very short periods.

In contrast, the longer-run trends on record have typically been of the forms suggested by Table 1. The particular magnitudes are of no concern for the moment, their significant feature being the general way in which they vary with age. It will be observed that the curves of the various columns would resemble a "reversed J" most frequently, a "near U" in some instances and an "L" occasionally. In each case they start from a peak at age 0, drop sharply in the first few years of life and vary mildly from about 5 to between 40 and 60. Thereafter the curves remain fairly horizontal or turn upward, at least to 85. Granted that some of the upper-age measures are of uncertain accuracy, nevertheless an upturn or at least the absence of any marked downturn seems highly probable. Moreover, examination of a large number of changes between successive life tables

[8] To repeat, all changes are relative to the numbers that would be found under constant mortality, not to the original N_t. The equality of $c_t'(t)$ and $c_t(t)$ would hold at each date although $c_t(t)$ would normally be changing.

[9] *See* G. J. Stolnitz, A Century of International Mortality Trends: I. *Population Studies*, July, 1955. 9, No. 1, pp. 24–55.

Table 1. Long-run changes in age-specific survival rates (p_l) for selected countries and periods, females.

Age	Country, Period*																	
	Aust. 1906 to 1947	Bel. 1896 to 1948	Den. 1903 to 1948	Fr. 1901 to 1951	Gy. 1906 to 1933	Neth. 1905 to 1951	N.Z. 1903 to 1951	Nor. 1906 to 1948	Sw. 1906 to 1948	Sz. 1906 to 1951	U.S. 1901 to 1950	Aus. 1903 to 1950	Fin. 1906 to 1951	It. 1906 to 1936	USSR 1897 to 1927	Cey. 1921 to 1946	Ind. 1896 to 1946	Jap. 1923 to 1950	Taiw. 1910 to 1938
0	5.9	10.8	7.7	11.2	12.3	10.9	5.2	4.4	6.0	9.6	9.8	16.2	9.0	6.6	11.6	7.5	11.3	10.1	2.3
1	1.4	3.6	1.6	2.8	3.2	3.3	1.0	1.5	2.0	1.9	3.1	5.4	4.2	3.9	3.6	2.2	.8	3.1	1.2
2	.5	1.8	.6	1.6	1.1	1.4	.4	.7	.9	.8	1.4	3.4	2.2	2.1	2.6	2.4	1.2	1.6	1.6
3	.3	1.1	.4	1.1	.6	.7	.3	.5	.7	.5	.9	1.7	1.7	1.2	1.9	2.8	1.2	1.1	1.5
4	.2	.8	.3	.8	.4	.5	.3	.4	.5	.4	.7	1.1	1.2	.8	1.4	2.2	1.2	.7	1.1
5	.2	.6	—	.6	.3	.4	.2	.4	.5	.3	.5	.8	1.0	.5	1.1	1.7	.9	.4	.8
10	.1	.2	.2	.3	.2	.2	.1	.3	.3	.2	.2	.4	.5	.1	.4	.6	.2	.2	.3
15	.2	—	.2	.4	.2	.3	.2	.4	.4	.3	.3	.4	.5	.3	.2	.4	.6	.7	.3
20	.2	.4	.3	.5	.2	.3	.3	.5	.4	.5	.5	.6	.5	.3	.2	.5	1.0	.7	.7
25	.3	—	.3	.6	.3	.4	.3	.5	.5	.5	.6	.6	.5	.4	.2	.6	.9	.5	.7
30	.4	.4	.4	.6	.3	.4	.4	.5	.5	.5	.6	.7	.5	.4	.3	.7	.6	.5	.8
35	.4	—	.4	.6	.3	.5	.4	.6	.5	.6	.7	.8	.5	.4	.3	.8	.3	.5	.8
40	.4	.5	.4	.6	.4	.5	.4	.6	.5	.6	.7	.8	.6	.4	.4	.8	.3	.5	.7
45	.4	—	.4	.6	.3	.5	.4	.5	.4	.6	.6	.7	.5	.3	.5	.8	.5	.5	.9
50	.3	.5	.4	.6	.3	.6	.4	.5	.4	.7	.7	.9	.6	.3	.7	.8	.7	.5	1.2
55	.4	—	.4	.8	.5	.6	.5	.6	.4	.9	.9	1.2	.6	.3	1.0	1.3	.8	.6	1.4
60	.6	.8	.4	1.1	.7	1.1	.6	.6	.4	1.4	1.1	1.8	.7	.6	1.4	2.0	.6	.7	1.3
65	.9	—	.4	1.7	1.2	1.3	.8	.6	.4	2.3	1.5	2.5	.9	1.0	2.2	2.9	.9	1.0	1.6
70	1.2	1.9	.4	2.5	1.5	2.0	1.2	.7	.5	3.2	2.0	3.4	1.0	1.8	2.6	4.8	2.1	1.7	1.7
75	2.0	—	.5	3.7	2.0	2.5	1.6	.8	.5	4.4	2.6	4.8	1.4	3.0	2.9	9.7	4.9	2.8	1.8
80	1.5	—	−.2	5.4	2.3	3.3	2.0	.9	.4	5.5	3.6	5.5	2.4	4.9	1.6	11.2	10.3	4.7	—
85	.8	—	1.1	5.4	3.0	3.3	.9	.4	.9	6.5	4.5	8.6	2.4	7.3	−2.9	13.4	19.7	8.6	—

Source: Life tables for individual countries.

* Countries are: Australia, Belgium, Denmark, France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland, United States, Austria, Finland, Italy, Union of Soviet Socialist Republics (European part), Ceylon, India, Japan, Taiwan. Years are mid-points of periods covered by life tables.

shows that similar overall patterns are found for shorter-run trends.[10]

Thirdly, since the possible increases in survival rates (up to a value of unity) are frequently small relative to their magnitudes, the leeway for actual increases tends to be limited. As Table 1 shows, even long-run changes are likely to be about 1 per cent or less at most ages. It is true that the changes at age 0 are much larger. But it should also be noted that the large majority of the infant survival changes on record have averaged a good deal less than 5 per cent per decade. Furthermore, the possibilities of shifts in age proportions are restricted in another way. Since any rise in the survivors at a given age also involves a rise in total numbers, the two increases tend to offset each other.[11]

The relatively limited effects of most mortality trends on age structure are explained by these two tendencies.

III

Turning to a more detailed analysis, we may think of a (single) survival movement having an age pattern much as in Figure 1. That is, a sharp drop occurs between the ages 0 and 1, followed by far more gradual declines in the next few years. The changes between about 5 and 45 are taken to be perfectly horizontal; as Coale has shown, this assumption generally involves slight errors.[12] Beyond 45 the curve may be supposed to remain relatively horizontal or to rise, the latter being probable. It will be further supposed that we can ignore the ages 90 and over. The proportions over 90 in actual populations are invariably well below 1 per cent and even very large increases in

[10] *See* Stolnitz, *op. cit.*, Part II, to appear in *Population Studies*, 1956. In most instances the life tables were based on the average experience of several-year periods and were about 5 to 15 years apart.

[11] In other words, since any $\frac{c_t'(t)}{c_t(t)}$ consists of a ratio of proportionate survival changes, the effect of a value above unity in its numerator is likely to be dampened because of a value above unity in its denominator.

[12] Coale, *op. cit.*, pp. 97–101; also, Stolnitz, *op. cit.*, Part II.

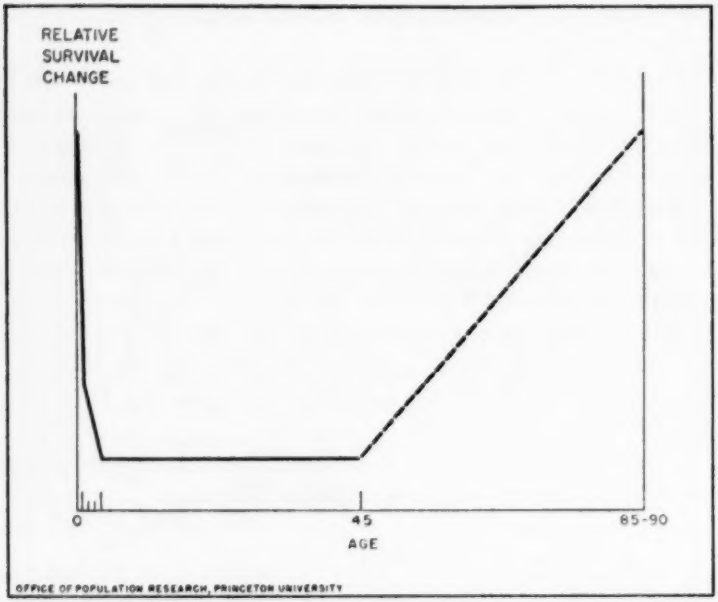

Fig. 1. General pattern of relative changes in age-specific survival rates (p_t).

the future would have negligible effects on the fractions under 90.

The problem of tracing age-structure effects can best be visualized in several stages. To begin with, of course, we postulate a population with given numbers by age as of an initial date and with unchanging vital rates thereafter. The particular numbers and rates are of little or no consequence.

(a) The first step is to consider a population which is initially identical in every respect but suddenly ("just after" time 0) experiences an equal percentage rise in all age-specific survival rates. The rise may be of any magnitude and corresponds to extending the horizontal part of Figure 1 over the entire age scale.

(b) Next, we may think of a second population exactly like the one in (a), except that it has had additional survival gains at the young ages (gains in addition to the horizontal part of

Figure 1). Specifically, such increases will be assumed to be 3 per cent between 0 and 1$\left(\frac{p_0'}{p_0} = 1.03\right)$ and very nearly 1 per cent in each of the next three years, or up to age 4. Survivors per birth to age 1 in this population would therefore be 3 per cent more numerous than in (a), 4 per cent at age 2, up to 6 per cent at age 4.[13] By assumption a 6 per cent rise would also hold for all later ages. It will be observed that these magnitudes rank among the higher changes encountered in Western populations over periods of 10 to 20 years.[14]

(c) The analysis of the effects of survival trends on age could stop at this point whenever no additional survival increases occur beyond 45. As Table 1 shows, such cases do arise. For purposes of general discussion, however, it is necessary to include a third and last step. This involves a population as in (b) but which has also experienced additional survival increases in the upper ages. If we assume that these increases slope upward at a rate of $\frac{1}{15}$ per cent per year of age from 44 to 88, the additional gains would come to 1 per cent between 58 and 59, 2 per cent between 73 and 74, and 3 per cent between 88 and 89. The total age function of survival changes for this population would therefore resemble a "U," or intermediate in its right-hand portion between the "reversed J" and "J" functions found in Table 1.

Reduced to essentials, the problem is to compare the age distribution that would develop in (b) with that in (a) and then

[13] These above numbers were chosen partly in the light of empirical considerations and partly to avoid fractions as much as possible. Strictly, a rise of 3 per cent in p_0, followed by a rise of 1 per cent in p_1 through p_3, means that the number reaching age 2 would increase by a factor of (1.03)(1.01), the number reaching age 3 by (1.03)$(1.01)^2$, up to (1.03)$(1.01)^3$ at age 4. The differences between these values and the ones in the text are negligible.

The technique of adding percentage changes rather than compounding ratios will be used throughout. Although it involves larger errors than the foregoing at some points, the biases are generally negligible. The main exception is at the older ages, where more extensive compounding is involved, this difficulty can be readily resolved, however, by supposing that the upper-age survival movements are in fact slightly smaller than the ones cited.

[14] *See* Table 1. The effects of much larger changes, such as have occurred in many "under-developed" areas since the war, are illustrated in Part IV.

to allow for the further effects of the upper-age changes in (c). The use of specific numbers at this point is largely for expository convenience. Alternative assumptions could be handled in analogous fashion and would give rise to analogous age-structure effects. Indeed, as will be discussed later, the effects resulting from one set of survival changes will often provide quick estimates of the effects in other situations.

(a) *Equal Relative Survival Increases at All Ages.* Since such changes would lead to the same age distribution as would exist with no change, this population may be substituted as the standard for further comparisons. The advantage of so doing is that we have to trace the changes in numbers at various individual ages and it is convenient to ignore the increases which occur in equal proportions everywhere. If persons aged 15–29 are 1 per cent more numerous because of a uniform gain in survival rates and an additional 5 per cent because of larger young-age gains, the latter value alone will affect the size of the group relative to the total population.[15]

Accordingly, all further references to changing numbers are in relation to the population under (a), not to the original population.

(b) *Additional Increases in Young-Age Survival Rates.* Given the assumed numerical changes, the situation at time 1 would be as follows: The number aged 0 would be the same as in (a), the number at age 1 would be 3 per cent higher and those at each year from 2 to 4 would be 1 per cent higher.[16] Since none of the groups 5 and over would have been affected as yet, the rise in the total population would be very small (far below $\frac{1}{2}$ per cent as a rule). The percentage increases in the age proportions below 5 would therefore be very nearly the same as the gains in population numbers, while the proportions

[15] Alternatively, of course, we could simply have assumed that the changes between 5 and 45 were zero.

[16] The lack of any change at 0 under our simplifying assumptions corresponds to the fact that the number 0–1 in an actual population would only partly reflect a previous rise in the infant survival rate.

at each later age would fall to the extent that total numbers had risen.

The corresponding calculation for later periods could be carried out in as much detail as seemed desirable. For seeing general patterns, however, we may limit the discussion to 15-year intervals of age and time. In this way we can most conveniently trace the changing numbers in the reproductive ages (15–44).

Time 15: The only 15-year groups with increased numbers at this date would be those 0–14 and 15–29. Since the sub-group 15–19 would be 2–3 per cent more numerous, the gain for the toal group 15–29 would be very close to 1 per cent.[17] Among those under 15, persons in each of the ages 5–14 would be 6 per cent more numerous. The rise in the 0–4 sub-group would come almost entirely from additional survivors per birth and amount to about 4 per cent. (The increases in survivors per birth by single years of age would be 0, 3, 4, 5 and 6 per cent, respectively, or an average of 3.6 per cent. To a slight extent, this sub-group would be further augmented by the rise in births shortly before time 15 from persons 15–19.) For practical purposes, therefore, we can assume a 5 per cent increase for the group as a whole.

Time 30: Persons aged 30–44 at this date would be 1 per cent more numerous, the same rise as was found for this cohort 15 years earlier. However, the cohort aged 15–29 would be 6 per cent larger (against the previous 5 per cent), since each annual sub-group would have had time to benefit from all the young-age survival gains.

The group aged 0–14 would be augmented in two ways. First, there would be about 5 per cent more survivors per birth, as at time 15. And secondly, the births themselves would be more numerous, since the reproductive cohorts would have gained in size. "Just before" time 30 the rise in births to persons 15–29 would be 6 per cent, this being the rise in their number at each

[17] The increases by single years of age from 15 to 19 would be 6, 3, 2, 1 and 0 per cent, respectively, and the gain for the entire sub-group would tend to be somewhat above the simple average of these values. Similarly, the rise in the total 15–29 group would slightly exceed the average of the increases in its 5-year components (3, 0, 0).

year of age. At time 15 the group 15–29 was 1 per cent larger, so that the average increase for the period as a whole can be taken as some 3.5 per cent. To a close order of approximation this would also be the rise in births from persons at these ages, again for the period as a whole.[18] In addition, births to persons above 30 would also have increased, say by $\frac{1}{2}$ of 1 per cent, as a result of the augmented numbers passing from 25–29 at time 25 to 30–34 at time 30.

In order to combine these component increases, we can use the fact that women 15–29 rarely contribute less than half or more than three-fourths of total births. For present purposes we can assume a 60–40 distribution, hence that the period rise in births would be about 2.5 per cent.[19]

In combination with the 5 per cent gain in survivors per birth this would raise the 0–14 group by 7.5 per cent. (By time 34, when all members of this group were aged 4 and over, the rise would go up to 8.5 per cent.)

Time 45: At this date persons 30–44 would be 6 per cent more numerous, compared to the 1 per cent increase found for these ages at time 30. Thus the average rise over the intervening period would be 3.5 per cent. The corresponding increases of persons 15–29 would be 8.5 and 6 per cent, or an average of somewhat above 7 per cent. Accordingly, the gain in total births between time 30 and time 45 would be very nearly 6 per cent ($.6 \times 7.0 + .4 \times 3.5$) and the number 0–14 would be more

[18] Since fertility rates typically increase from 15 to about 25, the gain in births could be expected to rise from less than 1 per cent at time 15 to the final 6 per cent. Thus the cited value is probably somewhat of an over-estimate.

[19] Let B denote the births that would have occurred with no young-age survival increases, and b and b′ the corresponding births to women 15–29 and 30–44. Then the new number would be $1.035b + 1.005b'$, the absolute rise $.035b + .005b'$ and the proportionate change $.035 \frac{b}{B} + .005 \frac{b'}{B}$. The cited overall gain comes from setting $\frac{b}{B}$ equal to .6 and $\frac{b'}{B}$ to .4. Although the fractions used in a concrete problem should be adapted to the given population, practically any reasonable choice would suffice. In the present case, for example, setting $\frac{b}{B}$ equal to .50 or .75 would imply a gain in total births of 2.0 or 2.8 per cent and subsequent gains would soon converge to a steady increase of about 3 per cent per period, as discussed in the text.

numerous by 11 per cent. The group 45–59 would be larger by 1 per cent and all older cohorts would still be as in (a).

Later Dates: Beginning with time 45 the gains in births would climb at a steady rate of close to 3 per cent per period, from the 6 per cent just noted to 9 per cent between time 45 and 60, and so on.[20] Table 2 presents the underlying computations. Thus at time 60 the increase in the number 30–44 would be 8.5 per cent, compared to 6 per cent at time 45, and the resulting rise in births about 7 per cent. The corresponding end-date increases for 15–29 would be 12 and 8.5 per cent, respectively, and the rise in births nearly 10 per cent. The overall gain in births would therefore be 9 per cent and the survivors aged 0–14 would be augmented by 14 per cent (compared to the 11 per cent rise for this age span at time 45).

And in general, the increases in numbers 15–29 and 30–44, hence in births, would continue to rise by very nearly 3 per cent in each later 15-year period. In turn, since the new survival rates hold for all cohorts of persons born after time 0, the same

Table 2. Computation of per cent increases in births during successive 15-year periods, under 6 per cent rise in 0–4 survivorship.[1]

Time	Per Cent Rise in Number[a]		Average Per Cent Rise, Previous 15 Years[b]		Per Cent Rise in Total Births, Previous 15 Years[c]
	15–29	30–44	15–29	30–44	
(1)	(2)	(3)	(4)	(5)	(6)
15	1.0	0.0	0.0	0.0	0.0
30	6.0	1.0	3.5	0.5	2.5
45	8.5	6.0	7.0	3.5	6.0
60	12.0	8.5	10.0	7.0	9.0
75	15.0	12.0	13.5	10.5	12.0
90	18.0	15.0	16.5	13.5	15.0

[1] *See* text and footnotes 16–19, 27.

[a] Rise at time 30 and each later date equals 6 per cent plus rise shown in column (6) of preceding row. Rise in number 15–29 at time 15 is approximately one third of rise in number 15–19.

[b] Average of rise shown in same and preceding rows of column (2) or column (3). Entries used as estimates of increases in births from cited ages.

[c] Equal to .6 × column (4) + .4 × column (5).

[20] This merely illustrates the general theorem discussed in Part IV: Given a total rise of x per cent in young-age survivorship, then the gains in births will approach a steady rate of increase of $\frac{x}{2}$ per cent per period.

relative gains would come to be repeated between the cohorts reaching a given age span at successive "census" dates and between successive age cohorts at the same date. Thus at time 90, when the population of time 0 would have disappeared, the gains would be 6 per cent for persons 75–89, 8.5 per cent for those 60–74, 12 per cent for 45–59, back to 18 per cent for 15–29 and 20 per cent for 0–14 (which would shortly become 21 per cent for this cohort). At time 105 the corresponding gains in numbers by age would be 8.5, 12, 15, back to 21 and 23 per cent; at time 120 they would be 12, 15, 18, back to 24 and 26 per cent; and so on.

It follows that essentially no further effects on age structure would occur after time 90. Each subsequent 15-year period would see an additional gain of 3 per cent (or very nearly this amount) at all age groups and in the total population, compared to the numbers that would have been found under unchanging mortality. Since the latter numbers would themselves be changing by a very nearly constant rate per period, the ratio of the two sets of age proportions at time 90 would tend to be repeated at all later "censuses."[21] For example, consider the dates 90 and 105. Let k denote the stable-age rate of growth per period implied by the original mortality situation. For each age we have $N_if_i(105) = kN_if_i(90)$, to a close order of approximation; similarity, $\Sigma N_if_i(105) = k\,\Sigma N_if_i(90)$. Let r_i denote the relative increases in the various numbers by age at time 90, or $\frac{N_if_i'(90)}{N_if_i(90)}$, under the given survival gains. Then the ratio of total numbers $\frac{\Sigma N_if_i'(90)}{\Sigma N_if_i(90)}$ would equal $\frac{\Sigma r_iN_if_i(90)}{\Sigma N_if_i(90)}$ and the ratio of the two age proportions at any age i would be r_i divided by this value. At time 105 the relative increase in the number at i, $\frac{N_if_i'(105)}{N_if_i(105)}$, would be $1.03r_i$, as we have just seen. The rela-

[21] A population subject to constant age-specific fertility and mortality will assume a fixed, "stable-age" distribution within a few generations. *See* Lotka, A. J.: *Théorie analytique des associations biologiques*, Part XII, No. 780 in the series ACTUALITÉS SCIENTIFIQUES ET INDUSTRIELLES. Paris, Hermann et Cie., 1939, especially pp. 64–77.

tive increase in total numbers would also have risen by the factor 1.03 since

$$\frac{\Sigma N_i f_i'(105)}{\Sigma N_i f_i(105)} = \frac{\Sigma 1.03\, r_i N_i f_i(105)}{\Sigma N_i f_i(105)} = \frac{1.03\, \Sigma r_i k N_i f_i(90)}{\Sigma k N_i f_i(90)}.$$

Accordingly, the shift in age proportions at time 90 would again be found at time 105 and, by the same argument, at all later dates.

For this reason Table 3, which shows the increases in members by age at successive dates, stops at time 90.

The remaining problem, therefore, is to see how total population size would change at times 15, 30, . . . , 90, in order to convert the above changes in numbers to changes in proportions. Two points should be noted in this connection. Obviously, the conversion factor at any date would be the same for all ages. Secondly, given the increases in numbers by age, the resulting total rise would depend on the distribution that would have been found under no change. Thus consider time 15, when the main variation was a rise of 5 per cent in the group 0–14. Suppose this group would otherwise have included 40 per cent of the population, a common magnitude in high-fertility areas. Then the rise in total numbers would be very nearly 2 per cent and the change in the proportion under 15 about 3 per cent $\left(\frac{1.05}{1.02} \times 100\right)$. On the other hand, suppose that the proportion

Table 3. Per cent increases in numbers by age at successive 15-year "censuses," under 6 per cent rise in 0–4 survivorship.[1]

Time	Age Group					
	0–14	15–29	30–44	45–59	60–74	75–89
(1)	(2)	(3)	(4)	(5)	(6)	(7)
15	5.0	1.0	0.0	0.0	0.0	0.0
30	7.5	6.0	1.0	0.0	0.0	0.0
45	11.0	8.5	6.0	1.0	0.0	0.0
60	14.0	12.0	8.5	6.0	1.0	0.0
75	17.0	15.0	12.0	8.5	6.0	1.0
90	20.0	18.0	15.0	12.0	8.5	6.0

[1] *See* text for derivation.

would have been as low as 20 per cent, or not far from current levels in some Western areas. In this case the rise in total numbers would be only 1 per cent and the change in the proportion under 15 about 4 per cent. The group 15–29, which had risen by 1 per cent, would show a – 1 or a 0 per cent change in relative size and the proportions for all older groups would fall by 2 or 1 per cent.

Since no restrictions are placed on the age distribution serving as standard, it is useful to see how total numbers might change in a wide variety of situations. Fortunately, this question poses few difficulties. As can be seen from Table 4, the results obtained by applying the preceding increases by age to the "old" population of France in 1946, and the "young" population of Brazil in 1940, come close to encompassing the range of demographically interesting possibilities.[22] It will also be noted that the increases based on the Brazilian distribution

Table 4. Per cent increases in total numbers at successive 15-year "censuses," under 6 per cent rise in 0–4 survivorship and illustrative age distributions.[1]

Time	Age Distribution from			
	France, 1946	Brazil, 1940	Sample of Censuses[2]	
			Low	High
(1)	(2)	(3)	(4)	(5)
15	1.3	2.5	1.3	2.7
30	3.1	5.2	3.1	5.4
45	5.6	8.2	5.6	8.4
60	8.6	11.3	8.6	11.5
75	11.7	14.4	11.7	14.6
90	14.8	17.4	14.8	17.6

[1] Increases by age are from Table 3. For each age distribution, the increase in total number at any date was obtained by multiplying the appropriate increases by age by the corresponding age proportions and then adding the products. Proportions reported for all persons 75 and over were used for 75–89 and persons of unknown age were excluded. *See also* footnote 21.

[2] To time 45 based on 142 age distributions, thereafter on 129 distributions (including France and Brazil) in United Nations, Demographic Yearbook, 1948–1954, and on selected Swedish censuses, 1750–1870.

[22] Use of the same age distribution as a standard for successive dates does not, of course, conform to our model, which is more general. Strictly, the French and Brazilian distributions should have been projected on the basis of the vital rates existing in 1946 and 1940, respectively. The contrasts between the two distributions are sufficiently great, however, to suggest the range of increase in total population for each date separately.

always exceed the ones deriving from the French data. This follows from our previous point that any change in total numbers is a weighted average of the changes by age. An age distribution such as Brazil's would give greater weight to the largest increases in numbers, which are always at the younger ages, and lesser weight to the increases at the older ages. In terms of regional comparisons, populations in Latin America, Africa and Asia would tend to have the largest increases in total numbers and Western countries the smallest, with intermediate changes in Eastern and Southern Europe. Whatever the population type, however, the increases in total numbers would tend to fall into a regular pattern of variation over time, the added gain per period approaching the 3 per cent increment in births.

The age-distribution effects shown in Table 5 are therefore suggestive in several respects. (All entries derive directly from Tables 3 and 4; for example, the increase of 3.7 per cent in the

Table 5. Per cent changes in age proportions at successive 15-year "censuses," under 6 per cent rise in 0–4 survivorship and two contrasting age distributions.[1]

Time	Age Group					
	0–14	15–29	30–44	45–59	60–74	75–89
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1. Age distribution in France, 1946					
15	3.7	−.3	−1.3	−1.3	−1.3	−1.3
30	4.3	2.8	−2.0	−3.0	−3.0	−3.0
45	5.1	2.7	.4	−5.3	−5.3	−5.3
60	5.0	3.1	−.1	−2.4	−7.0	−7.9
75	4.7	3.0	.3	−2.9	−5.1	−9.6
90	4.5	2.8	.2	−2.4	−5.5	−7.7
	2. Age distribution in Brazil, 1940					
15	2.4	−1.5	−2.4	−2.4	−2.4	−2.4
30	2.2	.8	−4.0	−4.9	−4.9	−4.9
45	2.6	.3	−2.0	−6.7	−7.6	−7.6
60	2.4	.6	−2.5	−4.8	−9.3	−10.2
75	2.3	.5	−2.1	−5.2	−7.3	−11.7
90	2.2	.5	−2.0	−4.6	−7.6	−9.7

[1] Based on Tables 3 and 4. *See* text.

first row is equal to $\left[\frac{1.050}{1.013} - 1\right] \times 100$.) For reasons just noted, they represent very nearly the limiting shifts to be expected from the assumed survival changes. The increases in the French age proportions would in every case be larger, or the decreases smaller, than the corresponding entries for Brazil. Analogous contrasts would be highly probable, had we selected any other young-age survival changes or practically any other areas of similar backgrounds. At the same time, the differences between the two parts of the table are perhaps less important than the secondary effects suggested by both. An increase of 5 per cent in the proportion 0–14 would raise the 1946 French value from 20.6 per cent to only 21.6 and the 1940 Brazilian value from 42.0 to 43.0. It is true that most of the percentage shifts in the proportions over 60 are larger. But it should be recalled that no allowance has been made for additional upper-age survival gains. Moreover, even if such gains did not occur, the absolute variations in proportions would again be small. A decline of 10 per cent in the proportion over 75 would lower the 1946 French fraction from 4.0 to 3.6 per cent and 1940 Brazilian measure from .9 to .8 per cent. Such variations are well within the range of values encountered in empirical studies.[23]

Finally, mortality declines up to 45 have a decided tendency to make a population younger. This will not only be the case when the upper-age survival gains remain at the 5–45 level, as here, but also when they rise to only a small fraction (approximately less than one third) the total 0–4 gain. The last has in fact been the usual situation in Western countries over most of the last century.

(c) *Additional Increases in Upper-Age Survival Rates.* The problem of modifying the foregoing for survival changes beginning about age 45 is relatively simple in one respect. Since such changes come at practically the end of the reproductive span, they have very little influence on numbers of births. The

[23] *See* for example, Sauvy, *op. cit.*, p. 679. Or, to put the matter another way, the small absolute differences in proportions often cited may in fact represent fairly substantial changes in percentage terms.

increases in numbers under 45 from a young-age survival movement can therefore be assumed to remain unaltered by developments at later ages. Only the age proportions under 45 are affected and all in equal degree. For example, suppose that upper-age survival gains raised total population at a given date by an additional 1 per cent, compared to what it would be in (b). Then the proportions 0–14, 15–29 and 30–44 would all be lowered by the same margin.

In another particular, however, the analysis is more complicated. The full effect of a young-age survival gain on the size of a given birth cohort is manifested within a short interval of time. Thus the entire (percentage) rise for each 15-year cohort in (b) was experienced within five years of its period of birth, whether the rise came from added survivors per birth or from added births. In contrast, the increased numbers resulting from upper-age gains tend to be cumulative. Under the gains assumed here, for example, an annual group reaching age 45 would rise by an additional $\frac{1}{15}$ per cent (over whatever increase had occurred at earlier ages). A year later, the same cohort would gain another $\frac{2}{15}$ per cent or a total rise of $\frac{3}{15}$ per cent. Two years later the total gain would be $\frac{6}{15}$ per cent and so on to age 89, when the total rise would be 69 per cent.[24]

For this reason, and to take account of both transitional and long-run effects, it is again necessary to deal with individual dates. This time, however, the increases in numbers are to be understood as being in addition to the ones already cited in (b).

Time 15: Consider the group 45–59. The sub-group just reaching age 45 would be more numerous by only $\frac{1}{15}$ per cent;

[24] The last figure comes from the sum $\frac{1}{15}+\frac{2}{15}+\ldots+\frac{45}{15}$ or $\frac{1}{15}\times\frac{45\times46}{2}$, following the familiar equality $1+2+\ldots+n=\frac{n(n+1)}{2}$.

the one aged 46 would have gained $\frac{1}{15}+\frac{2}{15}$ per cent; up to the one aged 59, whose gain would be 8 per cent $\left(\frac{1}{15}\times\frac{15\times16}{2}\right)$. The gain for the group as a whole would be a weighted average of these individual gains, the weights being the proportions at the various ages if there were no upper-age survival gains. Examination of a variety of censuses shows that the weights can be assumed to decline linearly and that setting the weights at about .1 for age 45 down to about .03 for age 59 is likely to entail only minor errors. Thus the gain for the total group would be very nearly 2.2 per cent, the figure used in Table 6.[25]

Among those 60–74, the oldest annual sub-group would have gained $1\frac{1}{15}$ per cent between 59 and 60, another $1\frac{2}{15}$ per cent at 61, up to $1\frac{15}{15}$ per cent at 74, or a total gain of 23 per cent $\left(15+\frac{1}{15}\times\frac{15\times16}{2}\right)$. The second oldest sub-group moved through the

Table 6. Per cent increases in numbers by age at successive 15-year "censuses," under 6 per cent rise in 0–4 survivorship and linear rise in old-age survivorship up to 3 per cent.[1]

Time	Age Group					
	0–14	15–29	30–44	45–59	60–74	75–89
(1)	(2)	(3)	(4)	(5)	(6)	(7)
15	5.0	1.0	0.0	2.2	14.6	29.6
30	7.5	6.0	1.0	2.2	16.8	44.1
45	11.0	8.5	6.0	3.2	16.8	46.3
60	14.0	12.0	8.5	8.2	17.8	46.3
75	17.0	15.0	12.0	10.7	22.8	47.3
90	20.0	18.0	15.0	14.2	25.3	52.3

[1] Columns (2)–(4) as in Table 3. *See* text for derivation of columns (5)–(7).

[25] With a substantially slower decline in weights, from about .08 to .04, the gain would be 2.6 per cent; with a steeper decline, from .12 to .01, it would be 1.7 per cent. For the above estimate to be in appreciable error the weights at the upper half of the age span would have to be consistently larger than the weights at the lower half.

ages (58–73) yielding increases of 1 per cent through $1\frac{14}{15}$ per cent; the third oldest $\frac{14}{15}$ through $1\frac{13}{15}$ per cent; down to the youngest sub-group, with $\frac{2}{15}$ through $1\frac{1}{15}$ per cent. It will be noted that any sub-group would gain $\frac{1}{15}$ per cent more than the next younger sub-group during each calendar year, hence would experience a 1 per cent larger gain for the entire 15-year period. The total gains by sub-groups would therefore range from 23 down to 9 per cent and the weighted average would come to about 14.6 per cent. Finally, since the same comparative gains would hold for successive sub-groups under and over 75, the gains for persons 75–89 would range from 24 up to 38 per cent, and the overall gain would be about 29.6 per cent.[26]

Time 30: Once again the group 45–59 would have sub-group increases ranging from $\frac{1}{15}$ to 8 per cent and an overall rise of 2.2 per cent. Persons aged 60–74 would have been 30–44 at time 0, hence would also have experienced all the survival gains to their attained age. By age 59 the total increase for each annual sub-group would be 8 per cent, and the further increases would be $1\frac{1}{15}$ per cent for those just reaching 60 at time 30, $1\frac{1}{15} + 1\frac{2}{15}$ for those 61, up to 23 per cent $\left(15 + \frac{1}{15} \times \frac{15 \times 16}{2}\right)$ for those aged 74. Compared to the population having no additional upper-age survival gains, therefore, the increases for these successive sub-groups would vary from $9\frac{1}{15}$ up to 31 per cent, with an estimated rise of 16.8 per cent for the group as a whole.

The youngest of the sub-groups aged 75–89 was 45 at time 0

[26] Using the alternative weights of the preceding footnote, the increases for the 60–74 and 75–89 groups would be 13.7 or 15.2, and 28.7 or 30.2, respectively. The range of variation would be somewhat larger at later dates, but again by unimportant margins.

and would have gained $\frac{2}{15}+\ldots+\frac{15}{15}+1\frac{1}{15}+\ldots+1\frac{15}{15}+2\frac{1}{15}$ per cent or a total of 33 per cent (the sum $\frac{1}{15}+\ldots+\frac{15}{15}=8$ appears twice, the value 1 appears fifteen times and the value 2 once). The next older sub-group (aged 46 at time 0) would have the same gains, except that the first value of $\frac{2}{15}$ would be replaced by $2\frac{2}{15}$ in passing from 75 to 76; its total gain would therefore be 2 per cent larger, or 35. The gains for successive pairs of older sub-groups would rise similarly, from 37 to 61 per cent, and the increase over (b) for the full group would be about 44.1 per cent.

Time 45: The computations just carried out would now apply to the groups 45–59 and 60–74. The only new situation would involve the 75–89 cohort, whose members were 30–44 at time 0. Each sub-group would have had all the upper-age survival gains to 74, or a total of 31 per cent, and the further gains would range from $2\frac{1}{15}$ per cent for those aged 75 to 38 per cent for those 89. The weighted average could be expected to fall in the neighborhood of 46.3 per cent.

Later Dates: Time 45 marks the end of all transitional effects. From this point on the percentage gain over (b) at any age from 45 to 89 would be the same at all dates. Whatever their gains before 45, the groups aged 45–59, 60–74 and 75–89 at any given date would always be augmented by an additional 2.2, 16.8 and 46.3 per cent, respectively.

Combining the effects of younger-age and upper-age gains would not, of course, affect the attainment of a stable-age situation by time 90. Any later "census" would show increases in numbers by age which would be 3 per cent above the increases of the preceding "census" (15 years earlier). As in (b), the cohorts found at successive dates in any given age interval would have the same (new) survival rates from birth to time of enumeration and hence the same percentage increase in sur-

vivors per birth. Accordingly, the difference between their increases would be entirely determined at birth.[27]

Tables 6–8 show the effects on numbers by age, total numbers and age proportions, respectively, when both young-age and upper-age survival changes are considered. The first consists simply of the increases in Table 3 plus the upper-age increases just cited. Similarly, the gains in total numbers of Table 7 come from adding the gains in Table 4 (for France and Brazil) to the ones that would result from applying these upper-age increases to the same underlying distributions. It will be seen that the effect of assuming a U-shaped curve of survival changes is to reverse a previous comparison; here the French distribution leads to the larger increases in total numbers. In another respect, however, the patterns in Tables 4 and 7 are similar, with the increments per period in each soon converging to a 3 per cent level.

Table 8 is based on Tables 6 and 7. As in Table 5, the most appreciable shifts in individual age proportions are at the old ages. This time, however, the latter show marked increases, rather than decreases, in relative size. As a result, there is a

Table 7. Per cent increases in total numbers at successive 15-year "censuses," under 6 per cent rise in 0–4 survivorship, linear rise in old-age survivorship up to 3 per cent, and two contrasting age distributions.[1]

Time	Age Distribution in	
	France, 1946	Brazil, 1940
(1)	(2)	(3)
15	4.9	3.3
30	7.5	6.2
45	10.1	9.3
60	13.1	12.5
75	16.3	15.6
90	19.4	18.6

[1] *See* Table 4, first footnote.

[27] The one contrast with (b) is that 3 per cent would no longer represent the difference between the increases of successive pairs of age groups as of the same date. For example, the increase in the number of persons 30–44 would be less than 3 per cent above the increase among those 45–59, since the latter would have experienced additional survival gains.

pronounced tendency toward a decline in the relative numbers at the main working ages (15–60) and toward an increase in the numbers at the ages of partial or total dependency. This combination of shifts can be expected whenever the upper-age gains rise to levels comparable to those at the opposite end of the age scale.

It is also worth illustrating the effects on age that would have been found, had we assumed the more common pattern of a "reversed J." Thus, with a linear rise of $\frac{1}{30}$ per cent in upper-age survival gains (up to a $1\frac{1}{2}$ per cent rise at 88–89), the increases in numbers by age beyond 45 would be half the ones cited in (c); similarly, the additional increases in total numbers would be half the differences between Tables 4 and 7.

Table 8. Per cent changes in age proportions at successive 15-year "censuses," under 6 per cent rise in 0–4 survivorship, linear rise in old-age survivorship up to 3 per cent, and two contrasting age distributions.[1]

Time	Age Group					
	0–14	15–29	30–44	45–59	60–74	75–89
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1. age distribution in France, 1946					
15	0.1	−3.7	−4.7	−2.6	9.2	23.5
30	0.0	−1.4	−6.0	−4.9	8.7	34.0
45	0.8	−1.5	−3.7	−6.3	6.1	32.9
60	0.8	−1.0	−4.1	−4.3	4.2	29.4
75	0.6	−1.1	−3.7	−4.8	5.6	26.7
90	0.5	−1.2	−3.7	−4.4	4.9	27.6
	2. age distribution in Brazil, 1940					
15	1.6	−2.2	−3.2	−1.1	10.9	25.5
30	1.2	−0.2	−4.9	−3.8	10.0	35.7
45	1.6	−0.7	−3.0	−5.6	6.9	33.9
60	1.3	−0.4	−3.6	−3.8	4.7	30.0
75	1.2	−0.5	−3.1	−4.2	6.2	27.4
90	1.2	−0.5	−3.0	−3.7	5.6	28.4

[1] Based on Tables 6 and 7. *See* text.

Some of the resulting changes in age proportions would be as follows:

Time	*0–14*	*15–29*	*30–44*	*45–59*	*60–74*	*75–89*
1. Based on Age Distribution in France, 1946						
15	1.8	–2.0	–3.0	–1.9	4.1	11.3
45	3.0	0.6	–1.7	–5.3	0.6	14.3
75	2.6	0.9	–1.8	–3.9	0.4	8.9
2. Based on Age Distribution in Brazil, 1940						
15	2.0	–1.8	–2.8	–1.7	4.3	11.6
45	2.0	–0.3	–2.6	–6.2	–0.4	13.2
75	1.7	0.0	–2.6	–4.7	–0.5	8.0

A tendency to declining relative size of labor force is again indicated, although to a much lesser extent than in Table 8. This last is, of course, to be expected, since smaller old-age survival gains are assumed. A more important result is that nearly all of the age-distribution shifts turn out to be secondary, although the underlying survival movements are by no means minor. This is generally true even if we measure the shifts in percentage terms. In absolute terms, only one of the age proportions in France and Brazil would shift by as much as a single percentage point.

IV

We are now in position to relax or at least reconsider some of our original assumptions.

1. One that is readily disposed of, since there is so little to say, is that survival changes occur instantaneously. As already indicated, year-to-year changes tend to vary irregularly with age, hence are not likely to yield conclusions of general interest. And even if this were not the case, the effects on age structure could only be brought out by means of extremely detailed computations. The age-mortality problem necessarily involves step-by-step projections, unless we are willing to limit ourselves to very special types of populations and time paths of change. Finally, in so far as the irregularities of annual changes cancel

each other over longer periods, the tendencies would be analogous to the ones already described. For example, suppose the specific survival changes assumed above had developed over a 15-year period, fertility rates again remaining constant and mortality first becoming fixed by time 15. Then the numerical effects on age structure would be as before except in one or two minor particulars. Since the rise in the numbers 0–14, 15–29 and 45+ at time 15 would be far below the ones shown in Table 6, we could proceed very nearly as if no changes at all had occurred before this date $\left[\frac{c_i'(15)}{c_i(15)} \approx 1 \text{ for all } i\right]$. At time 30, therefore, the increases by age and in total numbers would be almost the same as indicated previously for time 15. In turn, the corresponding lag would hold for each later "census" and very much the same stable-age situation as before would develop by time 105.

2. Secondly, the increases in Tables 3 and 4 under the given young-age survival movements can be readily adapted to other numerical assumptions (again using 15-year intervals of time and age as units). The central variable in any situation is the total percentage rise (over the 5–45 level) in the chances of surviving from birth to about age 5, i.e., the sum of the rises in the initial 4 to 5 years of life. The percentage increase in the size of each cohort born after the survival movement can be regarded as the outcome of an increase in survivors per birth and of an increase in births. The first of these components is (or in the case of the 0–14 group soon becomes) exactly equal to the total 0–5 rise. The second component comes close to being proportional to the same rise, the proportion depending on the cohort's period of birth. If the births are for the period 0–15, their increase is very small; if for the period 15–30, their increase is not far from half the 0–5 change; for 30–45 the increase almost equals the change; for 45–60 the increase is 1.5 times the change, and so on.[28] Accordingly, given two 0–5

[28] As the first of the cohorts experiencing the whole 0–5 survival rise fills out the reproductive ages, its increase is averaged with the (somewhat above) zero increase

(Continued on page 205)

survival changes, X and Y, the percentage increases in numbers by age at a given date under Y would be $\frac{Y}{X}$ times the corresponding increases under X, to a close order of approximation. The total population changes would be modified in the same way. In particular, given any assumed Y, the limiting effects on age can be approximated by applying the factor $\frac{Y}{6}$ to Tables 3 and 4 and then deriving the changes in age proportions as in Table 5.

The effects of upper-age survival changes are less amenable to rapid estimation, partly because more ages are involved and partly because the patterns of change may be more variable. To the extent that the curve of such changes can be regarded as linear, of slope S, the factor $S \div \frac{1}{15}$ can be applied directly to the preceding data (i.e., to the differences between Tables 3 and 6 and between Tables 4 and 7).[29] In fact, linearity from about 45 to only 75 would be sufficient for many purposes. Use of the 45–75 slope would yield quick approximations of the changing numbers at these ages and also in the total population; only the 75–89 estimates would be in risk of substantial error.[30]

Many of these considerations are illustrated in Table 9, which presupposes a 12 per cent rise in 0–4 survivorship and consis-

of the next older cohort, in determining the average growth at such ages over the preceding periods. The lag between the growth at the younger and older reproductive ages complicates the process somewhat, but essentially the tendency is for the first addition in total number of births to approach half the gain in survivors per birth. This addition tends to raise the size of the next following parental cohort, hence the births of the next following period, by the same margin. Once started (about time 45), the process of very nearly constant further additions per period continues indefinitely. *See* Table 2.

[29] In some instances, of course, the distribution within broad age groups should also be taken into account. *See* footnotes 24 and 25.

[30] Other possibilities are that the upper-age changes are decidedly not linear or first become manifest well beyond 45. To assume linearity beyond 45 in such cases would probably not lead to serious errors in the age-proportion shifts found below 45, since the errors in estimated total numbers would tend to be limited. Thus the pattern of effects would still be similar in overall terms to those already discussed. On the other hand, the errors in the proportions 45 and over might be large enough to require a completely new set of estimates.

tently rising upper-age gains, from $\frac{2}{15}$ per cent at 44–45 to 6 per cent at 88–89. All computations were carried out as in Table 8, using none of the above short-cut procedures. It is easily seen, however, that the results are practically identical under both approaches.

Table 9 is also interesting in another connection. Except possibly for periods of catastrophe, the assumed survival trends have only rarely been exceeded over intervals of 10–20 years. Moreover, although similar or even more rapid trends over comparable periods may well occur in some underdeveloped areas during the next half century, it is unlikely that they can be sustained for any considerable length of time. This is especially true at the young ages, where a repetition of 12 per cent increases would soon lead to near-zero mortality. The assumed

Table 9. Per cent changes in age proportions at successive 15-year "censuses," under 12 per cent rise in 0–4 survivorship, linear rise in old-age survivorship up to 6 per cent, and two contrasting age distributions.[1]

Time	Age Group					
	0–14	15–29	30–44	45–59	60–74	75–89
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	1. Age distribution in France, 1946					
15	0.3	−7.0	−8.8	−4.8	17.7	45.0
30	−0.3	−2.5	−11.2	−9.1	16.2	63.9
45	1.2	−2.8	−6.7	−11.3	11.2	60.6
60	1.6	−2.1	−7.5	−7.6	7.5	52.9
75	1.2	−1.8	−6.8	−8.6	9.9	47.1
90	1.0	−1.9	−6.2	−7.8	8.3	47.7
	2. Age distribution in Brazil, 1940					
15	3.1	−4.4	−6.3	−2.2	21.0	49.1
30	2.1	−0.2	−9.1	−7.0	19.0	67.8
45	2.6	−1.4	−5.3	−10.1	12.8	62.9
60	2.6	−1.0	−6.5	−6.7	8.7	54.5
75	2.3	−0.8	−5.8	−7.6	11.1	48.6
90	2.1	−0.8	−5.2	−6.8	9.5	49.3

[1] Derived in the same way as Table 8.

upper-age survival gains could conceivably continue for rather long periods, but their occurrence would presuppose a series of major revolutions in the care and prevention of old-age disease. Thus if the age-structure effects in Table 8 have been well above average for the past, those in Table 9 should rank among the highest to be expected at any time from short-run, "U-type" movements.

To illustrate the very nearly limiting effects that may result from movements resembling "reversed J's," we may assume a 12 per cent rise in 0–4 survivorship and a linear rise in upper-age gains extending up to 3 per cent. The increases by age from the first rise would therefore be twice the values shown in Table 3, while the further increases from the second would equal the ones described in (c) of Part III. Similarly, the increases in total numbers would be twice those in Table 4 plus the differences between that table and Table 7. The tabulation below presents some of the age-proportion changes:

Time	*0–14*	*15–29*	*30–44*	*45–59*	*60–74*	*75–89*
	1. Based on Age Distribution in France, 1946					
15	3.6	–4.0	–5.8	–3.8	7.9	22.0
45	5.4	1.1	–3.2	–9.9	1.0	26.4
75	4.7	1.2	–3.1	–6.9	0.6	15.9
	2. Based on Age Distribution in Brazil, 1940					
15	4.0	–3.6	–5.5	–3.4	8.3	22.5
45	3.8	–0.4	–4.7	–11.3	–0.6	24.5
75	3.1	0.0	–4.6	–8.3	–0.9	14.1

3. Thirdly, the techniques used in Part III for a single survival movement can readily be generalized in tracing the combined effects of successive changes. The increases by age and in total numbers after a series of changes are very nearly the sums of the increases that would be found if each survival movement occurred in isolation. Let I_T denote the increases by age that would result from the first change alone after T years (corresponding to any row in Table 6); let J_T denote the correspond-

ing increases that would occur T years after the second change; K_T the third set of increases, . . . As before, T has the values 15, 30, . . . , and the movements are assumed to occur at 15-year intervals. The successive movements may be of the same or different magnitudes; the main restrictions are that the survival trends are upward and that the 5–45 gains can be ignored. Then the increases by age would be given (very nearly) by I_{15} at time 15; by $I_{30} + J_{15}$ at time 30 (i. e., the increases at the various ages from the first change alone, 30 years after its occurrence, plus the corresponding increases from the second change alone, 15 years after its occurrence); by $I_{45} + J_{30} + K_{15}$ at time 45, and so forth. Similarly, the increases in toal population would be P_{15}, $P_{30} + Q_{15}$, $P_{45} + Q_{30} + R_{15}$, . . . , where P, Q, R, . . . denote the increases from I, J, K, . . . , respectively. For example, suppose we were dealing with a series of only two movements, each involving the same numerical changes as underlie Table 6. Then the increases by age at time 15 would be given by the first row of that table, those at time 30 by the sum of the first and second rows, those at time 45 by the sum of the second and third rows, and so forth. The rise in total numbers at these and later dates could be derived in exactly the same fashion from Table 7.[31] Such estimates would be approximate, since the accurate procedure would be to compound the ratios of successive survival rates (see footnote 13). But the errors would accumulate slowly unless a lengthy series of large changes were involved.

4. Finally, the effects of declining mortality on male age composition are likely to be very similar to those for females. Since the sex ratio at birth changes little over time, any increase in female births from improved female survivorship will be accompanied by a practically equal increase in male births. Thus, if

[31] Although no proof of these propositions is given here, their validity is not difficult to demonstrate. The reader can satisfy himself on this score by first considering two movements. It will be seen that, ignoring the question of compounding, the combined increase at each age and period would be the sum of two components: the gain (whether from increased survivors per birth or from increased births) resulting from the first movement plus the gain from the second. This implies that the effects on total numbers are similarly additive. Assuming next that the corresponding statements hold for any n changes, the same procedures can be followed to show that they would hold for n + 1 changes.

the former are rising by an additional 3 per cent per period, as in Part III, the latter will be rising at essentially the same rate. Also, the gains in young-age survival chances tend to be much the same for both sexes. The combination of these near equalities will generally result in highly comparable shifts in age proportions to about 60. Probably the only noteworthy differences that may be encountered in practice are at the upper ages, where female survival increases have often exceeded the gains for males. This possibility has not been given sufficient attention in the past, although it is especially interesting in connection with the "aging" of Western populations.

V

To sum up, the main links between mortality changes and age structure involve the following propositions:

1. The only measures of changing mortality which are appropriate for a general approach to the problem are proportionate or relative changes in survival rates. Because the usual emphasis in describing mortality trends has been on proportionate changes in mortality rates, rather than in their complements, this fundamental point has often been overlooked.[32]

2. The same point underlies the frequent finding in empirical studies that mortality movements tend to cause rather limited shifts in age distribution. A relative change in a survival rate is likely to be far below the relative change in the corresponding mortality rate.

3. The age-distribution effects of a given mortality movement are much more readily analyzed in relation to the distribution that would be found at successive periods without such movement, than in relation to the initial distribution. This distinction has been obscured by the tendency in the literature to deal with stable-age models, which have a constant distribution over time.

4. Year-to-year survival changes are of little interest, partly

[32] Nor is there any general way of applying measures of absolute change in mortality (or survival) rates, hence none for dealing with absolute changes in age proportions.

because their variations by age tend to be erratic, and partly because their cumulative effects on age structure are closely approximated by the average (relative) changes over longer intervals. Moreover, probably nothing very interesting can be said about survival downtrends, or average declines. These have been rare empirically and, like year-to-year changes, tend to vary in irregular fashion with age. For these reasons only uptrends are considered here.

5. The age patterns of survival increases (of a trend nature) have very typically resembled "L's," "reversed J's" or "near U's," the second being the most common. For practical purposes the changes between 5 and 45 can be assumed to be equal in each instance.

6. Proportionate increases in survival rates which are the same at all ages leave age composition unchanged. In essentials, therefore, the age-mortality problem is really to trace the effects of the larger increases to be expected below 5 and over 45. The combined influence of all age-specific survival movements may be regarded as the sum of the very nearly zero effects of the 5–45 changes and the effects resulting from the differences between these and the young-age and upper-age changes.

7. Additional increases at the young ages raise numbers by age and the total population in two ways: by increasing numbers of survivors per birth and by augmenting births (through the increased numbers in the reproductive years). Since age-specific fertility is assumed to be constant, both sources of increase have to be taken into account in tracing the effects of any young-age survival gain.

The analysis at this point is greatly simplified by several circumstances. The full (percentage) increase in any cohort, whether from added survivors per birth or from added births, is registered by about age 5 and remains the same at all later dates. Moreover, the increases from these sources can be combined by simple addition, with little loss of accuracy. Finally, the increases in births in successive periods begin to build up regularly after 30 to 45 years from the original mortality move-

ment. At later dates the additional (percentage) rise in births per period is very nearly equal to half the rise in the 0–5 survival rate.

8. The effects of young-age survival gains can be further simplified, at least for general purposes, by considering females alone to begin with and by dealing with 15-year intervals of age and time. The reproductive span of life is more closely defined for females than for males and the female span effectively ends before upper-age survival gains (when they occur) become significant. In estimating the increases in female births, therefore, only the young-age gains need to be taken into account. The use of 15-year calendar intervals permits a convenient identification of the increases in the first and last "halves" of the female reproductive span of life, hence of the increased births contributed by each half. In turn, these increases are readily converted into increases in total births, since the ratio of births among women 15–30 or 30–45 to total births tends to remain fixed when age-specific fertility is constant.

9. In any given population, the effects of male young-age survival gains on male age structure are likely to be very nearly equal to the effects found for females. Since young-age gains are almost certain to be much the same for both sexes, the resulting increases in survivors per birth should correspond closely. The increases in births will also be very similar, owing to the near constancy of the sex ratio at birth.

10. The effects of upper-age survival gains on the numbers reaching age 45 can be ignored for both males and females. For practical purposes, the full influence of such gains in either case is simply to add to the increases that would have been found after 45 from the young-age gains alone. (The latter, of course, would not begin to affect the population over 45 until a nearly equal number of years had elapsed.) The combined effects of young-age and upper-age survival gains on the total size of population can be established in similar fashion, by adding the changes caused by each in isolation.

Thus where the upper-age gains for females are appreciably

higher than for males, as is frequently the case, the differences first have to be taken into account at a late stage in the analysis.

11. To a close order of approximation, the transitional shifts in age proportions as a result of a single survival movement cease after 90 years; if we exclude the old ages, they cease after about 60 to 75 years. Thereafter the differences between the new proportions and the ones that would have been found under the previous mortality conditions remain very nearly constant. Thus only the first 60 to 90 years (four to six 15-year intervals) need be considered in order to establish the main transitional and long-run effects of a given survival trend.

12. Given a set of different 0–5 survival gains, the increases in numbers by age and total population which are caused by any one change can be used to estimate the increases caused by any other. It is a simple matter, therefore, to compare the age-proportion shifts arising from alternative numerical assumptions. The same is true of alternative upper-age changes, provided that these are rising more or less linearly beyond the 5–45 level.

13. Given a succession of survival movements (each of a trend nature), the combined (percentage) increases in numbers by age and in total population may be estimated by adding the increases, appropriately phased, that would be found from each movement alone. (For convenience, the movements may be assumed to occur at 15-year intervals.)

Finally, since the literature on the age-mortality problem has been largely concerned with Western populations, two further observations are worth making.

14. A given percentage decline in age-specific fertility would have practically no effect on age composition if accompanied by an equal percentage rise in young-age survivorship.[33] The "aging" of Western populations may therefore be looked upon

[33] In terms of the discussion in (b) of Part III, the combination of such changes would lead to zero increases in the survivors reaching age 4. The number at age 0 would be lowered by the extent of the fertility decline and the numbers at later ages would be smaller by decreasing margins up to 3. Since the population over 4 would be unaffected, the only increases that might arise would be from upper-age survival gains, as described in (c).

as the outcome of two broad tendencies. First, the percentage declines in Western fertility have been far greater than the relative increases in 0–5 survival rates. The net effects of these trends are the same as if the only movements were declines in early-age survivorship. Instead of the age proportions being raised in the younger years and then lowered, as in Table 5, the tendency in the West was to have early-age declines and upper-age increases. Secondly, these effects were often accentuated by the additional survival gains (over the 5–45 level) in the upper ages. Such gains have tended directly to augment the rise in upper-age proportions and, by raising total numbers, further to depress the young-age proportions. In other instances, when the age patterns of survival changes have been more or less L-shaped, upper-age movements have at least done nothing to offset the first of the above tendencies.

15. Assuming mortality declines continue in the West, their effects on age composition should be appreciably different from what they have been in the past. The maximum young-age survival gains still possible in Western populations are shown in Table 10. Since all are close to or below the 6 per cent level underlying Table 5, something like a 5 per cent rise in the proportion under 15 (or 3–4 per cent in the proportion under 30) is the most that can be expected from future trends. Moreover, this assumes practically zero survival gains at the upper ages. (If these were exactly zero, they would still be very close to the largest possible gains between 5 and 45.)

Considered by themselves, Western survival trends over the last century have showed a clear tendency to depress average age. In the future, however, the tendency should be strongly in the opposite direction. Indeed, as some recent trends suggest, age patterns resembling "J's" may well become frequent. To the extent that this is so, the effects on age structure would be analogous to those suggested by the differences between Tables 5 and 8.

As was stated at the outset, much of the recent interest in the age-mortality problem has come from the belated realization

Table 10. Maximum per cent increases still possible beyond recent age-specific survival rates in 13 Western populations, by sex.[1]

Age	Country[2]												
	Aust.	Bel.	Can.	Den.	Fr.	Gy.	Ire.	Neth.	N.Z.	Nor.	Sw.	Sz.	U.S.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	1. MALES												
0[3]	2.2	5.2	3.6	2.8	3.7	4.5	4.1	2.2	2.5	2.2	1.8	2.8	2.8
1	.3	.5	.3	.4	.6	.4	.8	.3	.2	.3	.2	.4	.2
2	.2	.3	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2	.2
3	.2	.2	.2	.1	.1	.2	.3	.1	.1	.2	.1	.2	.1
4	.1	.2	.1	.1	.1	.2	.2	.1	.1	.1	.1	.1	.1
5	.1	.2	.1	.1	.1	.1	.2	.1	.1	.1	.1	.1	.1
10	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
20	.2	.3	.2	.2	.2	.2	.3	.1	.2	.2	.2	.2	.2
30	.2	.4	.2	.2	.2	.2	.4	.1	.2	.2	.2	.2	.2
40	.3	.5	.3	.3	.5	.4	.5	.2	.3	.3	.3	.3	.4
50	.9	1.1	.9	.7	1.1	.9	1.0	.6	.7	.6	.6	.8	1.1
60	2.3	2.3	2.1	1.6	2.3	1.9	2.3	1.4	2.0	1.4	1.6	2.1	2.5
70	5.6	5.4	4.6	4.2	5.5	4.8	5.7	3.9	5.0	3.5	4.3	5.4	5.3
	2. FEMALES												
0[3]	2.2	5.2	3.6	2.8	3.7	4.5	4.1	2.2	2.5	2.2	1.8	2.8	2.8
1	.3	.5	.3	.3	.5	.4	.8	.2	.2	.3	.2	.3	.2
2	.2	.2	.2	.2	.2	.2	.4	.2	.1	.2	.1	.2	.1
3	.1	.2	.1	.1	.1	.2	.3	.1	.1	.1	.1	.1	.1
4	.1	.2	.1	.1	.1	.1	.2	.1	.1	.1	.1	.1	.1
5	.1	.1	.1	.1	.1	.1	.2	.1	.1	.1	.1	.1	.1
10	.1	.1	.1	.0	.1	.1	.1	.0	.0	.0	.0	.0	.0
20	.1	.2	.1	.1	.1	.1	.3	.1	.1	.1	.1	.1	.1
30	.2	.2	.1	.2	.2	.2	.4	.1	.1	.1	.2	.1	.2
40	.3	.3	.3	.3	.3	.3	.5	.2	.2	.2	.2	.2	.3
50	.6	.6	.6	.6	.6	.6	.9	.4	.6	.4	.6	.5	.7
60	1.4	1.5	1.3	1.4	1.3	1.3	1.9	1.0	1.3	1.0	1.3	1.3	1.5
70	3.8	4.1	3.4	3.9	3.6	4.1	4.8	3.4	3.4	3.0	3.7	3.9	3.6

[1] Rates are for annual age intervals. All but infant survival rate (p_0) are taken from life tables in every case since 1945. Infant rates are from vital statistics for 1953 or 1954. Maximum increases defined as per cent differences between unity and rates.

[2] Countries are: Australia, Belgium, Canada, Denmark, France, Federal Republic of Germany, Ireland, Netherlands, New Zealand, Norway, Sweden, Switzerland, United States.

[3] Both sexes.

that Western mortality trends have typically slowed, not fostered, the aging of their populations. It is rather paradoxical to contemplate that the earlier conclusion, though based on incorrect reasoning, may yet be borne out by events.

ANNOTATIONS

WHY FAMILIES MOVE[1]

THIS is a very superior study of some of the social and psychological factors affecting residential moves in the city. The research has been conducted under the joint sponsorship of the Bureau of Applied Social Research and the Institute for Urban Land Use and Housing Studies, both of Columbia University.

The research design is an unusually broad one. Most studies of residential mobility have followed an ecological approach, using census tract or block data in order to discover differences betwen mobile and stable areas. Relatively few studies have used the survey method to contrast mobile and stable households or to study the reasons for leaving one particular dwelling and moving to another. Rossi's is virtually the first study to combine all three approaches.

To achieve this combination, Rossi's group conducted 924 interviews in four Philadelphia census tracts. These four census tracts represent the four combinations of high and low social status and high and low residential mobility. Every *n*th household is interviewed, with this *n* varied to give approximately equal subsamples in each tract.

Information is collected about the ages of household heads, the size of the household, and their status and preference with regard to owning or renting. In the analysis, these data are built into an Index of Mobility Potential. The interviews also furnish information about attitudes toward present housing and neighborhood, with these data built into a Complaints Index. Together these two indexes provide a surprisingly potent means

[1] Rossi, Peter H.: WHY FAMILIES MOVE. Glencoe, Ill., The Free Press, 1955, x + 220 pp., $4.00.

for discriminating between households desiring to stay and desiring to move. (A prediction based on these two indexes is correct 75 per cent of the time, as opposed to 52 per cent if one simply predicts that every household wishes to stay.) To learn something about the motives behind actual moves, the households are asked about reasons for leaving their former dwelling and picking the one they now occupy. Finally, the interviews furnish data to show that stated anxiousness to move is closely correlated with intending to move within the next ten months. But what the interviews cannot show is whether these stated intentions are closely related to actual mobility behavior. To provide this check, each household is revisited 8 months later. It turns out that 80 per cent expecting to move actually do so; while of those expecting to stay only 4 per cent move.

The impressive set of findings produced by this design are too numerous to be reviewed in their entirety. Residents of stable neighborhoods have more social ties with their neighbors than do residents of mobile neighborhoods. This relationship is qualified by socio-economic status in an interesting way. High status individuals tend to have more contacts in general and therefore more contacts with their neighbors. But once the level of interaction is held constant, it is found that the residents of stable areas are more likely to have their friends or relatives within the local area. Thus while level of interaction is predominantly a function of status, its location is closely affected by neighborhood mobility. It also seems to be the case that residents of mobile areas, having fewer ties with their neighbors, are more apt to perceive them as unfriendly and as having lower class status than themselves.

The households that are most likely to move are young couples with several children who are renting but desire to own. Since their family size is rapidly changing, so are their housing needs. For this reason they are more mobile than single renters whose housing requirements are relatively fixed. When such couples are a little older, say over 35 years of age, they are less mobile because many of them have passed the stage of family building and their housing needs are changing less rapidly. Also a larger proportion of them own their homes instead of renting. At ages above 45 family size is again changing rapidly as chil-

dren leave the household. But this time changes in family size result in surplus room, which is less frustrating than insufficient room. Among married couples of the same age and housing tenure, those with children are more mobile than those without because they are more apt to be in need of space and, through their children, are more sensitive to neighborhood characteristics. As for couples with children, those renting are more mobile than those owning for several reasons. Rented dwellings tend to be smaller—a modal size of three rooms as compared with six rooms for owner-occupied dwellings. For this reason rented dwellings are less likely to meet the space requirements of a large household. This difference in capacity is further increased by the greater control which an owner exercises over his room arrangements as compared with a renter. Then too, more renters prefer to own than owners prefer to rent.

These findings help to clarify why specific households have the complaints they do about housing and neighborhood. The most common complaints concern the dwelling unit itself, with space complaints more frequent than those pertaining to heating or costs. Less frequent but no less effective are complaints about the neighborhood, particularly its social composition. Interestingly enough, nearness to job or church or relatives and friends emerge as secondary considerations. The same is true for calibre of local schools or shopping facilities. Relatively speaking, renters complain more about costs and shortages of space. Owners have better control over these aspects and complain relatively more about aspects over which they do not have control, namely, neighborhood characteristics. Complaints about space bear only a loose relationship to objective space pressures, as measured by number of rooms and household size. On the other hand, such complaints are much more likely when there has been a change of household size during occupancy of a dwelling. Apparently the absolute amount of space available to a family is not as important as becoming accustomed to a certain way of using it and then having to modify this usage because of an increase in household size.

Households have definite specifications in mind when they look for a new dwelling. Because they want to avoid the dissatisfactions of their previous dwelling, their specifications for

the new dwelling are closely related to their complaints about the old one. On the basis of these specifications they narrow the choice to a few dwellings. Only at this point do cost considerations enter in as a decisive element.

With regard to methodology, the author furnishes many examples of ways in which the survey method supplements the ecological approach, thereby strengthening the study of residential mobility. He offers one particularly cogent example of the fallacies that sometimes arise when a correlation between census tracts is generalized down to the level of individual households. Mobile census tracts have the highest proportion of single persons and childless couples. From this one might suppose that such households are more mobile than couples with children. However it turns out that all types of households in mobile areas have a higher turnover than their counterparts in stable areas. Moreover in the two mobile areas studied, couples with children prove more mobile than childless couples; and both prove considerably more mobile than single persons.

Besides the overall research design, Rossi's principal innovation is a scheme for analyzing the reasons affecting a decision. Reasons are classified in various ways on the basis of a set of questions which ask the respondent first to identify from a list those reasons that operate in his decision at all and then to assess their relative importance. The procedure is convincing but requires considerable familiarity with the area under study. Also, being rather elaborate, it consumes valuable interview time.

In summary, this book deserves a wide audience. Its many findings make it an important monograph in the field of residential mobility. This value is not lessened by an annotated bibliography. Its technique of reason analysis is applicable to a wide range of decision behavior. The author tells his story in 200 readable pages. Finally, it furnishes any course in sociological methods with an attractive case study in view of its readability, its solid results, and its warranted championing of the survey method.

ROBERT G. POTTER, JR.

PEOPLING THE BRITISH COMMONWEALTH[1]

PEOPLING THE BRITISH COMMONWEALTH is the most recent of a series of books to come from the versatile pen of Dr. G. F. McCleary. By training, a medical doctor, the author has exhibited a multiplicity of interests and talents. Until his retirement from active work his chief interests were in the broad social aspects of medicine and public health. He wrote on the British maternity and child welfare movement, on infant mortality, and on national health insurance.

Since his retirement from the field of public health his interest has turned to population. The resulting books have included THE MENACE OF BRITISH DEPOPULATION (1937), POPULATION: TODAY'S QUESTION (1938), RACE SUICIDE? (1945), and THE MALTHUSIAN POPULATION THEORY (1953). As may be judged from the 1937 and 1938 titles, the author's interest in population began at a time when the birth rates throughout the civilized world were practically at their lowest levels.

In PEOPLING THE BRITISH COMMONWEALTH, as in his previous books on population, the author conceives his main task to be that of taking the story to the public. He is characteristically modest in his claims regarding technical qualifications as a demographer and as an economist.

This reviewer has always found Dr. McCleary's style of writing and exposition delightful. He digs out for the reader interesting side lights of historical character and illustrates his points by frequent pickings from the classics. Thus, " 'My pork pies', said Priscilla Lammeter in SILAS MARNER, 'don't turn out well by chance.' " Dr. McCleary makes no effort to conceal his own stand on demographic problems. As already indicated, the title of a book may reveal his stand. Despite this, he also gives the impression of wanting to present both sides or all sides of a given question.

In the book under review the author first gives a treatment of the rise of the British Commonwealth. He then discusses the components of population growth, birth rates, death rates, and migration in the United Kingdom, Australia, Canada, New

[1] McCleary, G. F.: PEOPLING THE BRITISH COMMONWEALTH. London, Faber and Faber, Ltd., 1955, xv + 174 pp., 18 shillings.

Zealand, and South Africa. With reference to each country the demographic story is told in the context of economic development. The final three chapters are on redistribution of the population, dispersal by mass migration, and the outlook.

In brief, the story that is told is one of considerable migration of British people from the Mother Country to the others mentioned above during the Nineteenth Century. Then, largely because of declines in the birth rate in the United Kingdom, the Mother Country virtually ceased furnishing people to the other countries. In fact, for several years during the economic depression, the net flow was toward England. The author attributes this partly to the earlier advances of social legislation in England which made the people of that country reluctant to leave.

Since World War II, there has been renewed interest in stimulating migration from the Mother Country to the various countries of the Commonwealth, especially to Australia and Canada. This development within the British family of nations has been prompted mainly by a desire to enhance the general welfare of the entire Commonwealth, and to promote the feeling of interdependence of these people. Thus, although the demographic position of the United Kingdom is still one of "incipient population decline," the density of population in that area is still far above that of the outlying countries. The memory of her narrow escape in World War II has prompted Australia to take an active role in increasing her population. Dr. McCleary gives an account of the various types of bilateral financial assistance for stimulating migration from the United Kingdom to Australia and other countries of the Commonwealth. Dr. McCleary's last sentences in the book, however, issue at once a hope and a warning concerning the demographic future of the British Dominions: "British families have become small because British fathers and mothers wanted small families. If they had wanted larger families they could have had them. These Dominion postwar birth rates may, perhaps, mean that in these wonderful young countries—so richly endowed, so full of the things that make for the joy of life—if not in the Mother Country, fathers and mothers are now wanting more children. We are not without grounds for the hope that it may be so." (p. 169.)

One criticism that may be made against the book is that it is so little concerned with the aboriginal and colored populations of the Dominions. There are, of course, understandable reasons for this. The statistics of the Maoris in New Zealand, the aboriginals of Australia, and the non-Europeans in South Africa are poor. Yet it perhaps also could be said that the poor state of statistics for these people reflects in some degree the past indifference to these people. In this connection, one also notes that the title of the book apparently rules out consideration of British subjects in the relatively underdeveloped areas that never attained Dominion status. Criticisms of this character may be made, but they do not alter the fact that Dr. McCleary has provided a useful and interesting book.

CLYDE V. KISER

BOOKS

In Collaboration with the Milbank Memorial Fund

Approaches to Problems of Human Fertility in Agrarian Societies. 1951 Annual Conference of the Milbank Memorial Fund, 1952. 176 pages. $1.50.

Backgrounds of Social Movements. 1947 Annual Conference of the Milbank Memorial Fund, 1948. 204 pages. $2.00.

Biology of Mental Health and Disease. Proceedings of the Round Table on Medical Aspects of Mental Health and Disease. 1950 Annual Conference of the Milbank Memorial Fund. New York, Paul B. Hoeber, Inc., 1952. 720 pages, 218 illustrations. $10.00.

Current Research in Human Fertility. 1954 Annual Conference of the Milbank Memorial Fund, 1955. 163 pages. $1.00.

Epidemiology of Mental Disorder. 1959 Annual Conference of the Milbank Memorial Fund, 1960. 159 pages. $0.50.

The Family as a Unit of Health. 1949 Annual Conference of the Milbank Memorial Fund, 140 pages. $2.00.

Family Health Maintenance and Modification, The. A controlled, long-term investigation of family health. Proceedings of a Round Table at the 1953 Annual Conference of the Milbank Memorial Fund, 1954. 251 pages. $2.00.

Interrelations between the Social, Environmental and Psychiatric Disorders. 1952 Annual Conference of the Milbank Memorial Fund. 1953. 248 pages. $1.50.

Interrelations of Demographic, Economic and Social Problems in Selected Underdeveloped Areas, The. Proceedings of a Round Table at the 1953 Annual Conference of the Milbank Memorial Fund, 1954. 220 pages. $1.00.

Interrelationship Problems of Research in Human Resources and Population Dynamics. 1957 Annual Conference of Milbank Memorial Fund, 1958. 154 pages. $2.00.

Modern Population Research. By P. K. Whelpton. Lancaster, Pennsylvania, The Science Press Printing Company, 1943. 213 pages. $1.00.

Psychology in Relation to Health and Disease. 1959 Annual Conference of the Milbank Memorial Fund, 1960. 242 pages. $1.00.

Problems in the Collection and Comparability of International Statistics. 1948 Annual Conference of the Milbank Memorial Fund. 168 pages. $0.50.

The Promotion of Maternal and Newborn Health. 1954 Annual Conference of the Milbank Memorial Fund, 1955. 139 pages. $1.50.

Psychology in Public Health. 1957 Annual Conference of the Milbank Memorial Fund, 1958. 264 pages. $1.00.

Social and Psychological Factors Affecting Fertility. Volumes II, III, and IV. New York: Milbank Memorial Fund, 1950, 1952 and 1955. $1.00 each.

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